RAILROAD GAZETTE

SATURDAY, SEPTEMBER 13, 1873.

Bender, Latrobe and Smith's Improvements in Iron Bridges.

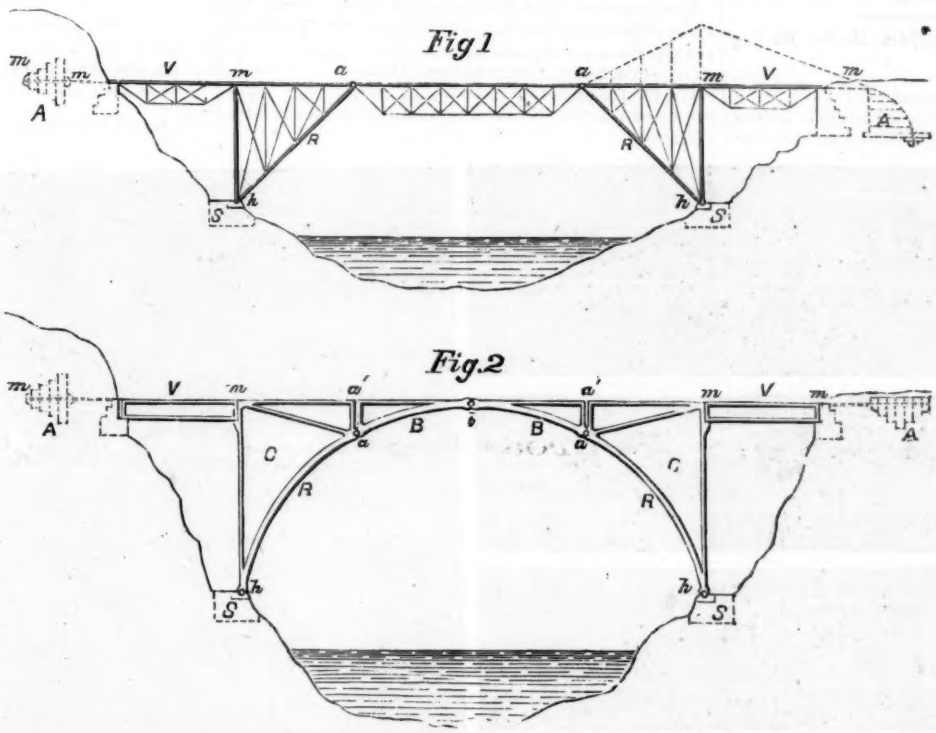
The accompanying diagrams illustrate improvements in the construction of trussed and arched bridges on the cantilever principle, recently patented by Charles Bender, of New York, and Charles H. Latrobe and C. Shaler Smith, of Baltimore, all of whom are connected with the Baltimore Bridge Company.

The improvements claimed are four in number, the first consisting in separating the skew-backed abutments of the straight or curved cantilever ribs from the anchorage, and in hinging the cantilevers at the skew-backed abutments, thus diminishing the quantity of masonry required, as the cantilevers do not depend on the stability of the masonry to resist the turning movements caused by loads or by changes of temperature. This may be seen in fig. 1, where *s* is the skew-backed abutment, *A* the anchorage, *m*, *m* the lines of anchorage sustaining the cantilevers, and *h* the hinges at the skew-backs around which the cantilevers revolve when the extremities *a a* are raised or depressed.

The second improvement consists, when the triple-hinged arch is used, in making the lines of anchorage rigid and capable of resisting a compressive as well as a tensile strain, the compressive strain being, in the triple-hinged arch, the result of certain partial loads tending to throw the cantilevers backward. This can be seen from fig. 2, when, if the arch be loaded between the points *a'*, *a'*, there will result from the peculiar character of the arch a backward movement of the cantilevers, which will be met by the rigid line of anchorage. The triple-hinged arch is illustrated in fig. 2, which shows the arch divided into four separate stiff parts, connected by hinges at the points *a*, *b* and *a*.

The third improvement consists in sustaining or combining the lines of iron or steel anchorage upon or with a permanent viaduct approach between the backs of the cantilevers and the fixed terminal points of the anchorage. This is done in such a way as to prevent all undulation, or injurious vibration, to enable the lines of anchorage to resist compression as well as tension, and also, when deemed necessary, to enable the lines of anchorage to resist, by the addition of a small amount of metal, the loading of the floor-way of the viaduct approach.

The fourth improvement consists in building arched bridges with three hinges intermediate between the skew-backs (the latter being hinged or not, as deemed best), combined with rigid lines of anchorage in such a manner that the three hinged points can be considered as fixed; and with reference to uniformly distributed loads, the same action will take place as if vertical forces were applied in said points, preventing their upward or downward movement.



IMPROVEMENTS IN IRON BRIDGES.

The abutment masonry, *S*, figures 1 and 2, is provided only to take up the pressure caused by the ribs *R*. The anchorage *A* has the sole office of holding the end points of the anchors *m*, *m*, in place against tensile, and, in the case of the arch, compressive forces. The anchors are carried on the permanent viaducts, *V*, *V*, so as to prevent stretching or sagging, and to remove objectionable deflection and vibrations.

The hinges are constructed with pins, pivots, or in any other suitable manner. Each part of the arch is to be treated as part of an ordinary arch, and provided with some stiffening construction, a braced spandrel, separate stiffening trusses, or such other arrangement as may be suitable.

Oxford Co-operative Car Company.

This company consists of about fifty experienced working mechanics, who have combined together in the co-operative plan to manufacture cars at Oxford, Pa. All the men are experienced mechanics, one of them was foreman in the Jackson & Sharpe Company's shop, another filled a similar position in the shops of the Philadelphia, Wilmington & Baltimore Railroad. They intend to build all classes of cars, from the smallest hand car to the most elaborate "palace."

The erecting shop and machine shop are completed, and the other shops are in progress. Each mechanic will contribute ten dollars per month to the capital of the company, which amount will be deducted from his wages. The town of Oxford has also loaned $50,000 for five years to the enterprise.

They are making every preparation for doing the very best kind of work, and so large a proportion of the men being skilled mechanics and individually interested in the success of the establishment, the cars built by them should be equal to the best built elsewhere. They are making preparations to supply the men with the latest and best information which is accessible.

Many persons interested in the system of co-operative labor will watch this project with much interest, and as all the social phenomena of modern times seem to point to co-operation as the solution of the present disturbed relation of capital to labor, the success of the Oxford Company's scheme would be an important step gained in this system of uniting the two.

Contributions.

What an "Inspector" would Discover in a few hours Walk on a Certain Western Railroad—and Many Others.

To the Editor of the Railroad Gazette:

It does not require a very extensive travel and observation to impress upon the mind of even a casual observer the importance of Mr. Goodwin's suggestion of a system of general railroad inspection. Although there are some roads so well managed that it is difficult to see wherein the most obtrusive detective could be of the least benefit to the company, there are not a few on which the services of one or more of these ubiquitous individuals could be made profitable. And there are others on which the management is so slack that the salary paid for bringing to light the shortcomings of the *heads* of department and employees would be money thrown away.

Speaking of "heads" of departments reminds me that I found a road a few days since that "needs a head put on it." At least it does not seem to be provided with that necessary appendage, nor even a tail wherewith to brush away the flies that suck the sweets from the company's till. I saw one swarm of men (they were not as busy as flies) vainly endeavoring to "right up" a bank sill at a trestle. Their labors did not amount to any great sum, but perhaps they were as successful as men generally are when undertaking a similar job. It is next to impossible to keep them up to a good bearing so that the cross ties are well supported, and a *shaky* track is the consequence.

There is hardly anything that gives trackmen more trouble than bank sills, as they are usually placed, and the engineer who will explain, through the columns of the Railroad Gazette, any plan of approach at trestles that is free from any of the objections of the bank sill should be entitled to a gold medal.

The writer could hardly resist the temptation to offer the foreman some advice, and try to assist him in his trouble; but, remembering the fate of the President of a New England road several years since, when kindly offering a suggestion to a section foreman, I refrained. This is how it was with him: The Rev. Mr. W., who was a celebrated divine, was also the popular President of the Boston & Worcester Railroad, and in those days the "Credit Mobilier" did not interfere with the legitimate business of that officer. In order to ascertain the condition of the road in all its details, he *walked* the entire length of the line. In the course of his travels he encountered a section foreman whose men were handling some new iron in a style worthy of a baggage-smasher, kinking it up in the most approved style, such as would fill a trackman of the period with delight. The President mildly suggested a little better treatment of so costly a material, when the "boss" told him to "go to hell." Says Mr. W., "That is the *last* place I should wish to go to." The foreman said: "That is the *last* place you *will* go to," and the interview ended by the reverend gentleman (who was a stranger to the "boss") laughingly proceeding on his travels—not to the place to which he was ordered to go, but to Worcester.

Leaving the man at the trestle to get out of his trouble by any makeshift *he* could contrive (for there was no one to whom he could apply for assistance), I soon fell in with a section foreman, who was trying his hand at shooting ducks in a pond adjacent to the track, while his men were watching the result of his practice and picking blackberries. Time, 9 a. m. This man, who was frank and communicative (uncommon traits in railroad men), began his career as a railroad man about a year since as brakeman on a freight train. Some time last spring the superintendent (for it seems that there is one on the road or somewhere) sent him to take charge of the section. His instructions were to get along the best he could. Since last April—four months—he has seen a man, whom they say is road-master, twice. He applied to him for such tools and supplies as his limited experience suggested as necessary. Again he was told to get along the best he could and he would soon be furnished with everything necessary; but he is left entirely to his own resources. He acknowledges his lack of experience as a trackist, but thinks he could do very well if he had something to do with, and if there was some one to look after him and give him instructions and supplies he would take a lively interest in the work. He would be glad to serve the company faithfully if they would give him any chance, but if they are satisfied with the way things are going he can stand it. He is not kept there by his own wish, for he feels that he is incompetent to fill the position, but he and his men are paid promptly and they are happy. Noticing a couple of rails a short distance off lying by the side of the track, I ventured to ask the cause of their removal. "They got bent," said he. "There were a couple of ties left out when the track was laid, and the rails got bent awfully. I used to be afraid of that place when I was braking on the train, and when I came upon the section I went for them two rails the first thing. I found a couple of straight rails down at the station, and I got them up here. Then I hunted the section all over for some ties, but found none, so I borrowed an ax and went over the fence and stole a tree and made a couple of ties. The next thing was to get the rails out. The claw bar I had would not pull a spike, and much as ever I could get the splice bars off with the wrenches we had. But we managed it after a while, and I believe that little job has kept some of them out of the ditch."

I left this man, hoping that he would some day "gravitate" to where his efforts would be appreciated, for he certainly has the right stuff in him to make a first-class trackman. My next interview was with a youth of about twelve summers, who was pleasantly situated on the sweep of a horse power in the shade of a water-tank. It was a one-horse power, and an ancient steed was slowly but surely forcing water into a tank, which was a nice one and certainly a credit to the road. The consumer of fire-crackers, peanuts and green apples had placed his hat (which was filled with the latter) on the cap of the power, and with his left hand he was providing himself with that great promoter of colic, while with his right he was industriously flourishing a strip of lath. Ever and anon the lath was brought to bear on the sides of the equine, which reminded me of Mrs. Grundy's wash-board. The tank building was a model of neatness, thoroughly built and provided with a windmill of the most approved construction, but I learned from the engineer of the horse-power that the windmill "got of order last spring and wants fixin', but they don't send no one here to do it. Hope they won't. Gives me an' ole Charley a soft thing on this yer pump."

But here comes a gravel train, and, being acquainted with the conductor, I can interview him without fear of being ordered where they have no skating rinks. He has 70 men under his care, and although he keeps them busy, he does not think the company can well afford to keep them employed in the manner they have been since last April. He was ordered to haul ballast to suit himself, to "patch up" where he thought it was most needed. He had left gravel on high embankments for the use of section men, but they being few and employed most of the time in keeping cattle off the track, the gravel was left to be washed down the embankments by the heavy rains. This process has been repeated several times in many places, and the embankments are nearly ruined. I noticed one embankment which was *very high* and *very long*, and is now *very narrow*. Early in Spring gravel was left there, and a washing rain carried it down the slopes, cutting the blue clay into innumerable channels and sweeping thousands of yards of that material to the bottom. More gravel was dumped, and the grooves were widened and cut deeper. Another application of ballast (hauled 16 miles) and the thin partitions of clay between the channels have vanished, and a large bed of clay and gravel is now quietly reposing at the bottom of either side of the embankment. The ties project over either side, which, together with the thousands of furrows on the slopes, reminds one of the skeleton of a huge serpent, or a dilapidated trestlework.

Mem.: To narrow an embankment cheaply and rapidly, leave gravel and sand where rains will wash it down the slope.

This company has paid some hundreds of dollars for hauling ballast on this "fill." It will now cost them some thousands to make it of proper width for safety, and some more hundreds again for ballast. Again, in some narrow cuttings gravel has been dumped and washed upon the track so as to cover the rails in many places in a manner decidedly dangerous, and the ditches being full of ballast, the road-bed is consequently very sloppy. Perhaps it would be better for the company if this man would lay up his train for a while and put under what gravel he has on hand. He knows how to do it, and he thinks

he could save the company some money if he were ordered to "go at it." He is bound to obey orders if he breaks owners, but if he had his way about it he would divide his gang. He has men enough to make a good lifting gang, and leave a good force in the gravel pit. He is "lugging" an army of men around over the road peddling gravel to be wasted; but that is none of my business. Meddlers are not generally well liked, and their hints are not always kindly taken; but as my intentions are good, I expect to be pardoned for saying that there is too much of this kind of work going on all over the country, but more especially in the Western States. There is said to be a Roadmaster on this road, but he seldom puts in an appearance among track or gravel train-men. He is only seen on occasional flying visits, and he only has time to say to those he meets, to "get along the best they can." The probability is that the Roadmaster is (for the sake of economy) kept busy in some other department, and the track is left to take care of itself. This road was well built, and travelers over this line admire the remarkable neatness of all freight and passenger buildings, woodsheds, tank-houses, shops, etc. Bridges are well built, and there is evidence of good taste and judgment throughout. It is pleasant to look upon these things, but there is an air of general neglect that is far from agreeable to those who delight in seeing every thing "ship-shape." Buildings begin to show a want of repairs, fence ditto, and the pumping arrangements are out of order along the line, and the track is getting bad. There seems to be money enough expended to keep everything in first-class condition if properly applied, but on this, as on a great many other roads, the only consideration seems to be *traffic*; forgetting that no railroad can be successfully operated with permanent way neglected. How is it on your road?

The Bracing of Bowstring Girders Under Rolling Loads.

To the Editor of the Railroad Gazette:

There have been many investigations of parabolic girders published, but in few of them do we find that simplicity of result which is of so great a value to the practical man, and without which they are of little use. The following discussion, although necessarily complex in itself, it is believed is simpler in its results than any which I have yet met with.

The general method of investigation is that pointed out by Baker, and which may be very briefly restated as follows: In any girder, if there be a difference of horizontal force on the chords at two contiguous vertical sections through the joints, that difference is the horizontal force on the braces which lie between these sections. The horizontal forces are obtained by dividing the bending moment by the vertical distance between the chords at the sections.

In the bowstring parabolic girder (see fig. 1) whose length is l and center height K, we will suppose the lower chord or string is divided into N equal panels, and on which is carried at the joints between the panels $N-1$ loads, either dead or live. The dead weight carried at each joint will be called W, and the live load W_1.

Counting the panels from the left abutment, we shall find at the end of the n*th* panel as follows:

The height of the the truss is

$$\frac{4K}{N^2} n (N-n) = h_n$$

A. Suppose every joint loaded with $w+w'$

The moment at the end of the n*th* panel

$$= M_n = \frac{n (w+w') l (N-n)}{2N}$$

and the horizontal force

$$= H_n = \frac{M_n}{h_n} = \frac{Nl}{8k} (w+w')$$

a quantity which is independent of n, and is, therefore a constant. The work of bracing will, therefore, be confined to transferring the load from the lower chord to the arch. This property is well known.

B. Suppose the n joints from the abutment to the end of the n*th* panel are loaded with $w+w'$, and the remaining joints with w only. The effect on the chords will everywhere be less than before, and on the bracing the action may be separated into two parts, the first due to the $N-1$ weights w, which is evidently $\frac{w}{w+w'}$ times what it was when wholly loaded, and the other part due to the n weights w'. We will consider this latter action as if it was the only load on the girder, the other being added for any particular piece.

Step 1st. The action of the brace increases from the abutments to the end of the load. This theorem is to be proved in two parts. Part 1st. The portion covered by the loads.

Let us count back from the end of the n*th* panel m panels toward the left abutment, and consider the state of things at the end of the $n-m$*th* panel from the abutment. Let the reaction of the left abutment which is carried by the n loads w' be called P_2:

Then—

$$M_{n-m} = \frac{P_2 (n-m) l}{N} - \frac{w' l}{2N} (n-m)(n-m-1)$$

$$h_{n-m} = \frac{4k}{N^2} (n-m)(N-n+m)$$

$$H_{n-m} = \frac{M_{n-m}}{h_{n-m}} = \frac{lN}{8K} \left\{ w' + \frac{2P_2 - w'(N-1)}{N-n+m} \right\}$$

From inspection of this fraction we find all the terms being constant but m, that H_{n-m} decreases as m is diminished, and that the rate of decrease is greater the less the value of m; therefore the first part of the theorem is true.

Part 2d. The part of the girder beyond the load. Let P_2 be the upward action of the right abutment caused by the n weights w'.

Let us count m' panels from the end of the n*th* and investigate at the end of the $n+m$*th* panel.

$$M_{n+m'} = \frac{P_2 l}{N} (N-n-m')$$

$$h_{n+m'} = \frac{4K}{N^2} (n+m')(N-n \quad m')$$

$$H_{n+m'} = \frac{P_2 Nl}{4K (n+m')}$$

which evidently grows less the greater the value of m', and with a decreasing rate. Therefore the second part of the theorem is true. Therefore, to find the maximum work on any braces, the load is to be considered from the abutments up to the end of the braces in question, first on one side and then on the other.

Step 2d. Two classes of girders will be considered as the simple form.

Class 1st. Girders with vertical posts and two diagonal ties in the panel; and Class 2d, the bracing formed of a single system of isosceles triangles. (See figs. 2 and 3.)

Class 1. *Girders with vertical posts and diagonal ties.*

In girders of this class a little consideration of the forces on the several bars will show that the brace in the panel in advance of the load has always more to do than the one in the panel next to it; that is to say, the work in the $n+1$*st* panel is greater than the n*th*, as follows:

The pull of the tie in the $n+1$*st* panel upward will carry the load at the end of the n*th* panel, and may also, if sufficiently large, cause a compression on the vertical at that joint. This compression will partly be resisted by the arch, and partly by the downward pull of the tie in the n*th* panel, but this pull is obviously only a part of that in the $n+1$*st* panel. We then arrive at this conclusion:

The greatest pull on the tie-braces is always to be found in the $n+1$st panel when there are n loads w'.

This work is thus to be found:

$$M_n = P_2 (N-n) \frac{l}{N}$$

$$M_{n+1} = P_2 (N-n-1) \frac{l}{N}$$

$$M_{n+2} = P_2 (N-n-2) \frac{l}{N}$$

$$H_n = \frac{M_n}{h_n} = \frac{Nl}{4k} \cdot \frac{P_2}{n}$$

$$H_{n+1} = \frac{M_{n+1}}{h_{n+1}} = \frac{Nl}{4k} \cdot \frac{P_2}{n+1}$$

$$H_{n+2} = \frac{M_{n+2}}{h_{n+2}} = \frac{Nl}{4k} \cdot \frac{P_2}{n+2}$$

$$H_n - H_{n+1} = \frac{Nl}{4k} \cdot \frac{P_2}{n(n+1)}$$

$$H_{n+1} - H_{n+2} = \frac{Nl}{4k} \cdot \frac{P_2}{(n+1)(n+2)}$$

Substituting the value

$$P_2 = \frac{w' n (n+1)}{2n},$$

we have

$$H_n - H_{n+1} = \frac{w' l}{8k}$$

for the horizontal component of the work on the tie sloping up from the load, in the $n+1$*st* panel, and

$$H_{n+1} - H_{n+2} = \frac{w' l}{8k} \cdot \frac{n}{n+2},$$

for that in the $n+2$d panel; this latter is useful in determining the work of the post at the $n+1$*st* joint.

For the work on the $n+1$*st* panel the horizontal component $\frac{w' l}{8k}$ is seen to be independent of the value of n, and is therefore a constant in any panel. We will state this as follows:

In bowstring girders with a single system of vertical posts and two diagonal ties in each panel, the maximum work of the diagonal ties has a constant horizontal component.

This statement I have not met with, though of course it may be in print.

Class 2.

In girders with a single system of isosceles bracing,

$$H_n = \frac{Nl}{4k} \cdot \frac{P_2}{n}$$

$$H_{n+\frac{1}{2}} = \frac{Nl}{4k} \cdot \frac{P_2}{n+\frac{1}{2}}$$

$$H_{n+1} = \frac{Nl}{4k} \cdot \frac{P_2}{n+1}$$

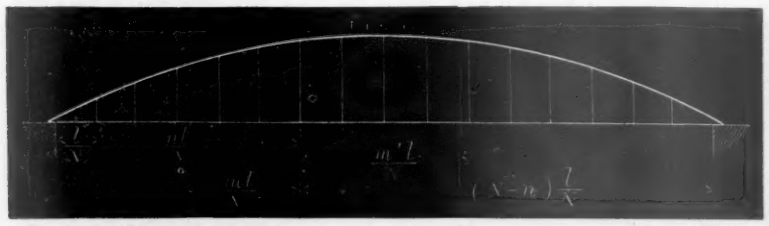
$$H_n - H_{n+\frac{1}{2}} = \frac{w' l}{8k} \cdot \frac{n+1}{2n+1}$$

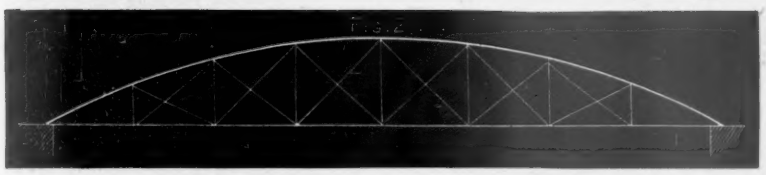
$$H_{n+\frac{1}{2}} - H_{n+1} = \frac{w' l}{8k} \cdot \frac{n}{2n+1}$$

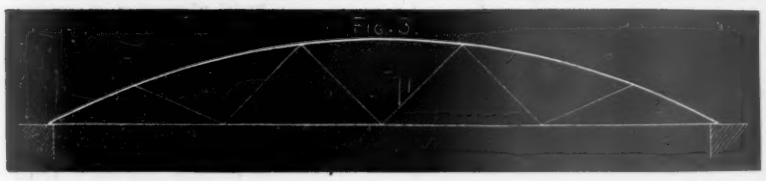
These quantities are neither of them constants but admit of easy computation.*

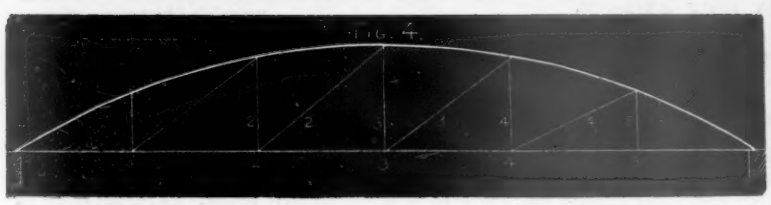
The horizontal component being known, the force on the brace is readily found by computation or graphically.

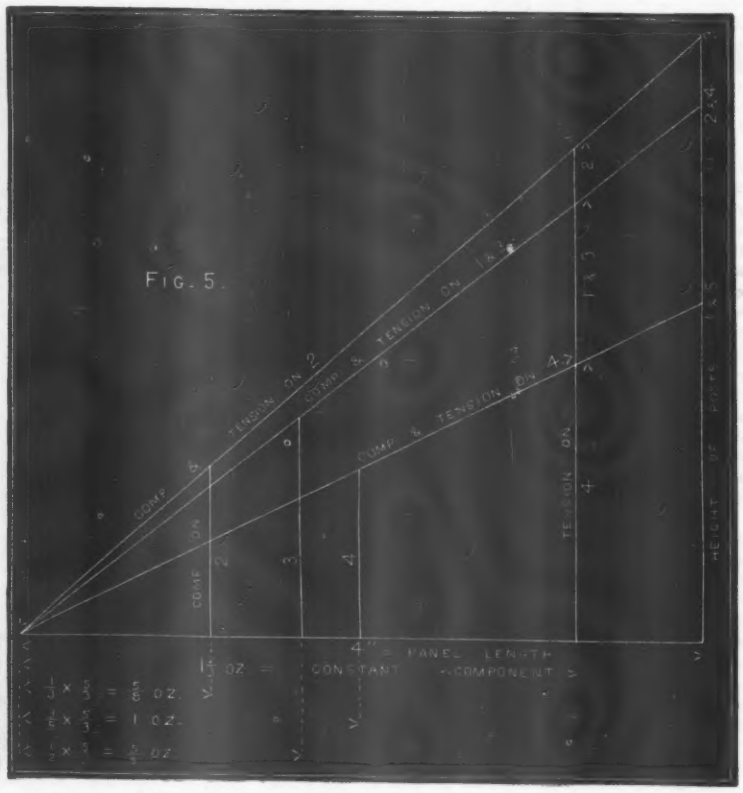
As an example of this method, let us take the model girder so eloquently described by Gen. T. G. Ellis, in his paper read at Chicago last June. (See "Transactions American Society Civil Engineers," June 5, 1872, copied by *Engineering* and the Rail-











* The values given for girders of the second class will be approximations, as the portions of the arch between the attachments of the bracing approximate to straight lines. If there are many points of attachment the values will be sensibly correct.

ROAD GAZETTE.) See fig. 4. In this little girder the dimensions and weights were as follows:

b=24 inches. K=36 " W=2 ounces. N=6. See Figure 5.

$$\frac{w'1}{8K}=\frac{2\times24}{8\times3.6}=\frac{6}{3.6}=\frac{1}{0.6}=1\tfrac{2}{3}\text{ ounces}$$

for the horizontal components sought. Constructing a series of triangles with the common base line 4 inches and perpendiculars corresponding to the heights of the posts in order equal two inches, 3.2 inches, 3.6 inches, 3.2 inches, and 2 inches and taking a scale of one ounce = 2 inches, we have 1.86, 2.13, and 2.24 ounces for the various tension diagonals, and in this model for the compression diagonals also.

For the work of the posts take the vertical component of the work of the diagonal which comes to the lever end of it minus whatever load may be directly carried there.

From the formula for the work in the n+2d panel we have $1\frac{2}{3}$ ounces $+\frac{n}{n+2}$ for n = 1, 2 and 3 we have $\frac{n}{n+2}$ = 1-3, 1-2, 3-5 respectively, laying these values off upon the same triangles (fig. 5) we have only to scale the compression upon the n+1st post. The tensions upon the n+1st post will be the vertical components of the compressions upon the diagonals in the n+1st panel, and will be scaled at once.

Tabulating these results and comparing them with the experimental data, we find an agreement which is highly satisfactory.

Maximum Forces on Diagonals in Ounces.

Joints Loaded.	Strain on.	Maximum Tension.	Maximum Compression.	Scaled from Figure 5.
1	1	2.1	....	2.13
1, 2	2	2.2	....	2.24
1, 2, 3	3	2.2	....	2.13
1, 2, 3, 4	4	2.0	....	1.86
5, 4, 3, 2	1	....	2.2	2.13
5, 4, 3	2	....	2.3	2.24
5, 4	3	....	2.1	2.13
5	4	....	1.8	1.86
Forces on Verticals.				
2, 3, 4, 5	1	1.3	....	1.33
3, 4, 5	2	1.6	....	1.5
4, 5	3	1.3	....	1.33
5	4	.8	....	.83
1	2	....	.5	.5
1, 2	3	....	.7	.66
1, 2, 3	4	....	.5	.5

CHAS. A. SMITH.

The Humber Tunnel.

A somewhat novel plan has been proposed by Mr. John Fowler, a well-known English engineer, for the construction of a railroad tunnel through the sandy bed of the river Humber at Hull. This plan is described in a leading editorial in our able contemporary *Engineering*, from which we make the following extracts:

We may premise, in the first place, what will be conceded by all, that if an ordinary rectangular pneumatic caisson, such as is used for bridge piers, be sunk to the requisite depth, it will be just as easy to build a short length of tunnel in the working air chamber at the base of the caisson as to fill in the said chamber with solid concrete—as would be done were it, as usual, made an integral portion of a bridge pier. It follows, as a corollary, that a number of isolated lengths of tunnels might, in this manner, be laid in the bed of a river, and that the only novelty involved would be as to the junction of these separate lengths.

It will at once be apparent that whilst in the case of the pier, a part, at least, of the caisson must be left in the ground, since the masonry is built upon it, in the case of the tunnel the caisson may be withdrawn, and the bed of the river may be restored to its original level.

The appliances pertaining to ordinary caisson work consists of pontoons for carrying the machinery and materials, with the requisite moorings for securing them in position, of the caisson itself, with its working air chamber and shafts, of guide piles for regulating the sinking of the caisson, in connection with tackle for preventing the too rapid descent of the caisson before it has sufficient hold in the ground, and of weights to force it down if the ground has, on the other hand, too much hold on the caisson.

Now, in Mr. Fowler's design, the whole of these appliances are contained in one simple and efficient apparatus, which he terms the "working vessel." Three of these vessels, each equal to the construction of a length of 160 ft. of tunnel at an operation, were proposed to be employed by Mr. Fowler, and the following description of one will apply to all:

A rectangular pontoon 160 ft. long by 42 ft. wide, and 12 ft. depth, with a working air chamber or diving bell of similar dimensions attached to its bottom, and a deck for machinery carried upon columns at a sufficient height above the top of the pontoon to be clear of the water at all times, constitute the chief portion of the apparatus. The requisite air and water shafts, supply pipes, and other means of communication between the air chamber and the said deck, were also provided, and a number of screw piles and heavy mooring chains were ranged along each side of the pontoon, and worked by suitable steam-driven apparatus placed on the machinery deck. In addition to the working vessels, a few air-tight ballast barges were provided to perform a double function, which will be hereafter referred to, and it may be here noted that the pontoon itself was weighted with 1,200 tons of slag ballast.

The mode of constructing a length of tunnel by Mr. Fowler's process would be as follows:

The position of the first length of tunnel being determined, and a number of screw moorings with buoyed chains being fixed at the requisite points, the pontoon, with its self-contained appliances, would be conducted by steam-tugs, at slack water of flood tide, to its position between the buoys, and the mooring chains previously referred to as being attached to the pontoon, and worked by machinery on its upper deck, would then be secured to the buoys, when the pontoon would be hauled into a sufficiently exact position. The next step would be either to allow the working vessel to ground with the falling tide, or, should the bed of the river not be suitable for such a process, to run down the screw piles while the pontoon was still floating, so that at low water the working vessel would be supported partly by its lower edge (which would to some extent have cut into the bed of the river), and partly by the screw piles. When fairly entered in the sand, the ballast barge previously referred to would be floated over, and sunk upon the top of the pontoon, the water would next be expelled from the working chamber by pumping in air, and men would then enter the chamber and get out the excavation by means of sand pumps and other well-known and economical expedients. When the excavation had reached a depth of 24 ft., the top of the pontoon would be level with the bed of the river, and as the sinking progressed the ballast barges would bury themselves in the sand, and so perform their second function of keeping the sand from flowing over the top of the pontoon, and so impeding its subsequent raising.

The working vessel being thus sunk to a depth a trifle below that of the invert of the proposed tunnel, bricklayers would replace the excavators, and the lower half of a couple of single line railway tunnels would be built by them in the air chamber. At each end of the tunnel head walls would be built, with a view to exclude the sand, but not the water. The inner half-thickness of these walls would be of brickwork, and the outer half of weak mortar, the utility of which will be apparent hereafter.

This work having progressed so far, it would become necessary to raise the working vessel to admit of the upper half of the tunnel being completed. To do this it would be first necessary to lighten the apparatus, and this introduces us to one of the most elegant features of Mr. Fowler's design, and the one which was persistently misunderstood by the opposing engineers throughout the entire case, to their own complete discomfiture in cross-examination. In Mr. Fowler's design complete control over the raising and lowering of the caisson is obtained by the simple manipulation of a couple of valves—an air valve and a water valve—and all irregularity of ascent or descent is checked by the screw piles attached to the sides of the vessel. As previously explained, both the working vessel and the barges are self-floated into position, and since they are heavily ballasted it is obvious that the admission of a few hundred tons of water would suffice to sink them; the admission of a further quantity would enable them to resist the upward pressure of air in the working chamber; while the admission of a still further quantity would supply the necessary additional downward pressure to overcome the friction of the sand against the sides of the caisson, which downward pressure, it is obvious, might be considerably increased at the time by inducing a slight temporary reduction in the pressure of air in the working chamber.

In the same manner the converse operation of raising the caisson would be effected by converse processes. Thus by expelling a certain quantity of water from the chambers of the pontoon and barges by the admission of air, the downward pressure arising from the weight of the apparatus would be neutralized, and by expelling a further quantity a buoyancy would be imparted to the apparatus sufficient to cause it to overcome friction and tear itself out of the sand if unchecked by the screw piles. This limit would not be approached too closely in practice, since screw-jacks were proposed to be used by Mr. Fowler as auxiliaries in the raising of the caisson.

Reverting, now, to the description of the construction of the first length of tunnel, the step subsequent to those already described will be to raise the caisson by the admission of air to the chambers in the pontoon and barges, and by screw-jacks, to a sufficient height to admit of the upper half of the tunnel being built. As the raising progressed, puddle would be filled in at the sides of the tunnel, in the place previously occupied by the stiffeners and gussets of the air-chamber sides, and when the necessary height had been attained, puddle would be filled in over the top of the tunnel also. Dependence is not placed by Mr. Fowler upon the puddle solely to exclude the water, but, as the brickwork progressed, it would be paid over with a specially prepared elastic asphaltic mastic which would be perfectly impervious to water.

The first length of tunnel being thus completed, the ballast barges would be first floated off, and then the pontoon itself would be similarly floated, and moored in a new position. Assuming the adjoining length of the tunnel is next to be undertaken, the working vessel would be moored as near as possible to the completed length, say, within one foot of its end. Sinking would then be effected as before, and it will be obvious that in its descent the cutting edge of the caisson would shear through the weak mortar, which, as already explained, was placed at each end of the first length of tunnel. The one-foot space between that tunnel and the caisson would consequently be filled by an artificial film of self-sustaining mortar, instead of running sand, which would otherwise have been the case. When the lower half of the tunnel was complete the caisson would be gradually raised in successive steps, and during such raising the junction of the two lengths of tunnel would be effected as follows: The caisson being lifted, say, 9 in., the men would remove a portion of the weak mortar lying outside the edge of the caisson, and would so prepare a bed for the brickwork necessary to join up the two lengths, which bed would be kept clear of the sand, which would otherwise have flowed in, by the portion of the weak mortar film which would still remain. The bricklayers would then join up the two lengths by passing their hands under the edge of the caisson and bonding the bricks into the toothings of the old tunnel in the usual way. The inconvenience, if not the impractibility, of making the junction in this way was much dwelt upon when the bill was before the House of Commons, so Mr. Fowler himself, as well as a practical contractor for him, determined to test the validity of the objection by the actual construction of a joint under analogous conditions. No difficulty at all was experienced in executing the work, and its soundness was well attested by the specimens produced in the House of Lords committee room. To still further silence objections, Mr. Fowler pointed out that the joint, if weak, could be readily reinforced by iron tubing, so that absolute immunity from leaking was cheaply attainable.

CHICAGO RAILROAD NEWS.

Illinois Central.

In August the company sold 2,007.2 acres of construction land for $12,641.60, and 120 acres of free lands for $1,080, and the land department collected $40,718.76 in the month.

The estimated earnings of the traffic department were:

Estimated Earnings—Traffic Department.

	In Illinois. 707 Miles.	In Iowa. 402 Miles.	Total. 1,109 Miles.
Freight	$408,000.00	$87,350.80	$490,350.00
Passengers	112,760 82	40,207 90	152,968.72
Mails	6,375 00	3,059.24	9,434 24
Other sources	93,325.00	2,555.76	95,880.76
Total, August, 1873	$615,460.82	$133,172.90	$748,633.72
Total actual earnings, Aug. '72.	653,768.14	129,487.01	783,255 15

This is a decrease of 5⅞ per cent. in the Illinois earnings, an increase of 3 per cent. in the Iowa earnings, and a decrease of 4½ per cent. in the total earnings.

Chicago, Danville & Vincennes.

This company has commenced work at Dolton on its new track from that place to Chicago. It is intended to have the grading completed in two months, and the track in running order by the middle of September.

The Evansville and Terre Haute express now leaves the depot, with Woodruff parlor and sleeping coaches, at 6:30 p. m.

The Commissioners' Freight Rates.

The new schedule of freight rates prepared by the Board of Railroad Commissioners is undergoing discussion by railroad men, and the generally-expressed opinion is that it is wholly impracticable. It will result in a diminution of the receipts for freight of from 25 to 40 per cent. If the lower rates should operate to increase the shipments, it would be not so bad, but the schedule seems to have been made with no reference to that end, and the railroad officials cannot see how the new rates can operate to increase the bulk of shipments. Fortunately this official schedule will be likely to be thoroughly discussed before it goes into force, since it is not made effective until about two weeks after the commencement of the next session of the Illinois Legislature.

In the meantime the farmers are just now receiving a large amount of instruction in political economy from Secretary Smith, whose utterances are published *in extenso* by the Chicago papers. Mr. Smith is undoubtedly a smart man; but his efforts to still further antagonize the railroads with the farmers will plague the instructor at some time. Mr. Smith, in a recent speech, took pains to inform his hearers very emphatically, that those who "handled" the farmers products were not producers; the middlemen and railroads were not creators of wealth. He did not tell how much the agriculturist would obtain for his corn and wheat in Central Illinois if railroads were annihilated. A few figures showing the difference between the prices of farm products at the farm and at the place of consumption would probably show whether railroads were or were not producers of wealth. But this man's speeches, which are numerous and long, ignore utterly all economical principles, the simplest laws of supply and demand even, as well the particular laws of the economy of transportation, which latter are generally ignored.

Chicago & Pacific.

This company has just completed its bridge across the Fox River, and expects to have trains running into Elgin by the 15th of the month. The bridge is about 50 feet north of that on the Galena Division of the Northwestern road. The track thence to Elgin lies along the west bank of the river, nearly parallel with the Northwestern track, but much nearer the river and at a considerably lower level. The company is about building a fine depot near the bridge on Chicago street. Last week the contract was let to Messrs. Gregg & Munger for the grading of the 50 miles from Elgin to Byron, on the Rock River. This work is to be done by the first day of next December. The contractors have sublet the entire portion, and work has already been commenced at various points on the extension. This portion of the road is an almost air-line, there being only two curves in a distance of 30 miles. The route is a little north of west, Byron being about 7 miles further north than Elgin, and just about halfway between the Galena and Falton lines of the Northwestern, which will no where be more than 12 miles north or south of it, except west of Rochelle, where the Chicago & Iowa will be within 10 miles. With it completed, not a farmer in Northern Illinois west of Freeport and north of the Chicago, Burlington & Quincy, would be more than 6 miles from a railroad, except in a little tract in Lake County. The engineers are making plans for the bridge over Rock River, which is to be a substantial and somewhat costly structure. The road leaves the Fox River by way of the Tyler Creek bottom. The company has just received a new locomotive, the fourth now in use upon the road. Fifty additional freight cars have just been ordered.

Chicago Transfer Railway.

A company by this name has been organized in Chicago, to build a railroad in a crescent entirely around the city, to be used to transfer cars between the different roads entering the city. The road is to commence at Grand Crossing on the Illinois Central and to run thence along Seventy-first street to the dividing line between Lake and Lyons townships and thence north to Montrose, the crossing of the Milwaukee & St. Paul and the Wisconsin Division of the Chicago & Northwestern. From Montrose the road will hereafter be extended to Evanston. The entire length of the line will be about 20 miles, and the right of way for some 12 miles has already been secured. The necessary surveys are now being made. The required sidings will be put in at the crossing of each road, and extensive yards will be built at some central point, for the reception and distribution of cars. Arrangements have been made for the purchase of 10 locomotives and a small number of passenger cars, but the company does not expect to own freight cars. In connection with the transfer business, the directors propose to manage a clearing house to facilitate settlement of differences on through freights between the various railroad companies in Chicago.

It is claimed that the new company can make a daily transfer of all the through cars arriving in the city at a cost much below the present actual cash expenditure for the insufficient service, and in a time and manner impossible under any other system.

The company expects to begin grading shortly and to complete its road in three months. The capital stock is $500,000, and the incorporators and directors are H. B. Latrobe, T. S. Dobbins, B. F. Allen, Howard Priestly, R. C. Meldrum, George S. Bowen, D. N. Welch and James Walsh.

Railroad Manufactures.

The Baltimore Bridge Company, of Baltimore, Md., in addition to the contract for the new bridge over the Susquehanna at Havre de Grace for the Philadelphia, Wilmington & Baltimore road, has on hand contracts for bridges equal to about 11,400 lineal feet of single-track bridging. The two principal contracts are the four-track iron approach viaduct to the St. Louis Bridge, and the bridge over Red River, on the Cairo & Fulton.

The buildings of the Jacksonville Car Company, at Jacksonville, Ill., are nearly completed, and the works will be put in operation in a few days. The company has already considerable orders.

The Manchester Locomotive Works, at Manchester, N. H., are now working on a contract for 50 standard-gauge locomotives for the Grand Trunk Railway, 16 of which have been already delivered. The works now employ 680 men and turn out from 12 to 15 locomotives per month.

The Master Car Builders' Association.

The committee appointed at the Boston meeting to prepare drawings and patterns of a standard journal box held a meeting at West Albany, N. Y., September 3. There were present Messrs. F. Childs, of the Great Western of Canada; George R. Bentley, of the Norwich & Worcester; F. D. Adams, of the Boston & Albany; W. E. Chamberlain and W. R. Slocum, of the same road; Enos Varney, of the Fitchburg; Wm. Johnson, of the New York Central & Hudson River; Joseph Jones, of the same road; L. Garey, of the New York & Harlem Railroad, and George Hackett, of the New Jersey Central. Mr. F. D. Adams presided. Mr. Joseph Jones, of the New York Central & Hudson River, who had been appointed a sub-committee to prepare the drawings and patterns, submitted his report, which was adopted after a few modifications had been made in the patterns and drawings.

During the meeting, at a given signal, all the workmen and employees of the Central & Hudson River Railroad shops were called together and addressed by Hon. Henry R. Pierson, in a brief speech, in which he informed the men of the object of the meeting, and remarked that the officers of the road, from Mr. Vanderbilt down, stood ready and were anxious to adopt any and every valuable improvement brought forward; that Mr. Vanderbilt especially was anxious to encourage his workmen in developing any new idea that might suggest itself—in short, he wanted them all to succeed in their special branches of business. Mr. F. D. Adams also made a short address.

RAILROAD GAZETTE

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CONTENTS.

Editorial Announcements.

Removals.—The Chicago office of the RAILROAD GAZETTE *has been removed to No. 77 Jackson street, opposite Third avenue.*

The New York office of the RAILROAD GAZETTE *is removed to Room 131, No. 73 Broadway, opposite the upper elevator landing.*

Correspondence.—We cordially invite the co-operation of the railroad public in affording us the material for a thorough and worthy railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Inventions.—No charge is made for publishing descriptions of what we consider important and interesting improvements in railroad machinery, rolling stock, etc.; but when engravings are necessary the inventor must supply them.

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

MECHANICAL SKILL.

Nearly all who are obliged to employed skilled mechanical labor of any kind have occasion to feel oppressed by the great sea of blind, stupid, blundering ignorance which rolls before and around them in a state of constant unrest. Nearly everywhere the complaint is made that "good men are scarce," "the old-fashioned workman is disappearing and there are none of equal skill to take his place." There can be no doubt that the supply—at least relatively to the demand—of skilled workmen is diminishing in quantity and deteriorating in quality. Now this decrease implies a great reduction in the productive capacity of the population, and it may therefore be worth while to give the subject some consideration.

The old system of apprenticeship—at least as far as the mechanics who are employed in large works are concerned—has become obsolete. While it prevailed, the apprentice was, to a certain extent at least, a member of his master's family. His habits of life as well as his instruction in the art and practice of his trade were under the immediate supervision of his employer. The one by precept and example taught and the other learned the habits of life, the method of doing business, and in fact absorbed as it were somewhat of the character of the other. In his occupation any want of skill, of industry or patience was soon detected and corrected. The peculiarities of the one became known to the other, and a process of adaptation naturally took place. In this way the whole character as well as the skill of the apprentice were in constant training during the time of his indenture. The master and apprentice were each acquainted with and felt a greater or less degree of interest in each other.

In contrast with this, let us look at the system now practiced in our large machine shops. In a railroad shop there is no proprietor excepting a "soulless corporation." The Superintendent of Machinery is so far removed from the apprentices that he perhaps does not know their names even. Usually he is so much occupied with the multiplicity of his duties that there is not time for him, even if he felt the inclination, to take any interest in their welfare. The consequence is that the apprentice is thrown upon the care of the shop foreman, who feels little or no responsibility, and therefore may or may not take an interest in his welfare and instruction. After working hours there is of course no supervision or interest in his conduct on the part of his employers. Now it is in this respect, we believe, that the present system, as compared with the old, is most defective. The time of life between seventeen and twenty-one years of age—the usual period of apprenticeship—is the time when few are safe if not subject to advice or control. There is, therefore, very little reason for surprise that there is more insubordination among the workmen of the present day than there was of old. This very often is an obstacle in the acquisition of the skill which can only be acquired by patient perseverance and industry. It a record could be procured of the number of apprentices who complete their apprenticeship, it would show, we believe, that a very large proportion leave their employers before their "time" expires. The temptation to work somewhere else for an advance of wages is often too strong, especially if some cause of offense or discontent happens to arise.

That it is impossible to revive the old system of apprenticeship any one will see who realizes the changed condition of things now compared to what they were in the old days. The change, however, only makes it apparent that some modification of the system of apprenticeship is necessary to adapt it to the new order of things. Some influence must be substituted for that which the master formerly exerted over "his boys."

Quite singularly, too, just as this question presents itself for solution, there has also come a demand which was but little felt by the apprentices of former days. When a boy's highest ambition and duty was to learn how to build a cart wheel or make a good job of finishing an ambitious piece of furniture, there was but little demand for much other knowledge, excepting the mechanical skill pertaining to his craft. Now, however, with the advance and improvement in all engineering works, there is a growing demand for men of skill and men of knowledge. Every civilized nation of Europe is now turning its attention to the development of technical knowledge among its working men. In this country, too, we have somewhat vaguely realized this want and have established schools for theoretical instruction, and attached to some of them workshops to give students practical experience. Almost universally the latter have proved to be failures, and we believe that the present great defect in our method of technical education—we cannot call it a system—is that the schools and the workshops are separated too far. The students leave the schools with too little practical experience, and the apprentice finishes his "time" with little or no theoretical knowledge. Instead of the technical schools and their teachers working hand in hand with the workshops and the engineers to the extent to which they should, we find the one inclined to sneer at the other because of his ignorance of science, and the last jeering at the first for his inability to turn his knowledge to any useful purpose. The problem before us then is, to bring the two branches of knowledge into harmonious and helpful relations to each other.

This, we believe, could be accomplished if encouragement were given in some substantial form to those disposed to educate themselves in this two-fold manner. There is hardly a railroad company in the country which would not contribute in some way, directly or indirectly, to develop a coal mine, if thereby it could be supplied with a better quality of fuel. Several companies have, at considerable expense, planted trees along the lines of their roads for the purpose of ultimately supplying cross-ties. While nearly every railroad corporation in the country would be disposed to expend money in this way to procure better fuel or cross-ties, very few, we fear, would feel inclined to be at any expense for the production of superior knowledge or skill. Nevertheless the latter would probably be more profitable than the former, and money expended in the cultivation of knowledge would doubtless yield a larger return than if employed in cultivating trees, and mines of information would pay better than deposits of coal.

It would of course be very difficult to say precisely how money could be most wisely expended to accomplish the object in view. Fortunately, however, we are able to refer to the experience of one of the leading living mechanical engineers, who a few years ago devoted a portion of his private fortune to furnish "the means for bringing science and industry into closer relation with each other." We refer to what are known in England as the "Whitworth scholarships," which were founded a few years ago by Sir (then Mr.) Joseph Whitworth. * In 1868 he invested a fund, the revenue from which is divided into thirty scholarships of £100 (about $500) each per annum, these scholarships to be applied to the farther education of young men, selected by open competition for their intelligence and proficiency in the theory and practice of mechanics and the cognate sciences. To secure these scholarships candidates must undergo an examination on those branches of science on which mechanical engineering is based, and another in certain handicrafts allied to engineering. In devising this two-fold scheme, Sir Joseph Whitworth's object was, while requiring a practical acquaintance with a few simple tools as a *sine qua non*, to render the competition accessible on fairly equal terms to the student who combines some practice with his theory, and to the artisan who combines some theoretical knowledge with perfection of workmanship, thus making the number of marks obtainable in the theoretical subjects and those obtainable by the most skilled workman about equal.

* We are indebted for most of the following facts in relation to these scholarships to an article published in *Iron* of August 9, 1873.

The theoretical examination is now conducted by the Government Department of Science and Art, and embraces the following subjects, namely: Practical, Plane and Solid Geometry; Machine Construction and Drawing; Pure Mathematics; Theoretical Mechanics; Applied Mechanics; Acoustics, Light and Heat; Magnetism and Electricity; Inorganic Chemistry; Metallurgy; Steam; Freehand Drawing.

The practical examination is taken charge of by Sir Joseph Whitworth himself, with whom there are associated Mr. Ramsbottom, ex-President of the Institution of Mechanical Engineers, and Mr. E. J. Reed, late Chief Constructor of the Navy. This examination includes the following handicrafts: 1. Smith-work; 2, turning; 3, filing and fitting; 4, pattern-making and moulding; and it is imperative on the part of each candidate that he be able to use one or more of the following classes of tools: 1, the axe and adze; 2, the saw and plane; 3, the hammer and chisel; 4, the file; 5, the forge; 6, the lathe for metal-turning.

At Sir Joseph Whitworth's works there is a large workshop of which one side is specially fitted up for the competition in practical workmanship; the only work that is done elsewhere is the turning and the smith's work.

Some estimate may be formed of the practical nature of the competition when a few specimens of the kind of work that may be called for are selected. For instance, under "forge work" each candidate had to be able to do one of more of the undermentioned pieces of work: 1. To weld or join together two pieces of iron three-quarters of an inch square; 2, to make a pair of smith's tongs; 3, to make the head of a hammer; 4, to make a pick; 5, to make two feet of ¼-inch chain with hook and ring; 6, to make a horseshoe complete; 7, to cut off and draw out chipping chisel, or drill and afterwards harden; 8, to make a pair of small callipers; 9, to make a pocket square.

A correspondent of the *English Mechanic* gave the following very interesting account of the competition of a previous year:

"At a quarter to nine on the morning of the 30th, sixteen of the eighteen workmen were assembled, and were conducted out of the office at five minutes to nine into the workshop, in which their practical abilities were to be put to the proof. The greater number of these had to go to the fitting test at the vise, which was a very good one. A turned piece of steel was required to be squared to gauge for a certain distance, and a bored hole in a cast-iron boss had to be squared out to fit this accurately, so that it might be just pressed in by hand. The turning required was to bore two cast-iron bevel-wheels accurately to the gauge, turn two wrought-iron mandrels to fit them, then finish and scrape up the whole surface of the wheels. The pattern making was no less easy, the task being to make a pattern of a bracket or support with a cored hole, drawing supplied. The time allowed for each of these operations was eight hours.

"The students' examination was slightly easier, the time allowed for each subject being two hours. The vise tests were two, one of the hammer and chisel, the other of the file. The former test was to take a chipping off a 6in. face of cast-iron, leaving it as smooth and true a surface as possible from the chisel. The proof of the student's capability in filing was to file up a cube to gauge, and also a hexagonal nut. Besides this there were four other tests—1st, the lathe, at which the candidate was required to turn up a bearing and small portion of shaft from a short section of bar iron; the forge, at which a drill and chisel were to be drawn out from bar steel and hardened, and also to forge a pair of callipers; the axe, where a piece of timber had to be squared to pattern, and an axe handle required to pattern, a spokeshave being allowed to finish with; lastly, the saw and plane, at which the candidate was required to make two straight-edges, each two feet long, width to gauge, thickness to measure, and to saw out of a plank and square two pieces of timber to a certain thickness and length. Some of the students and even the workmen who were allowed to engage in some of these latter tests, in lieu of the other, went away with blistered hands, especially at the forge, and all appeared to be glad when it was over.

"Sir J. Whitworth generally looked round at least once a day, and seemed to take much interest in the endeavors of the earnest competitors."

The successful candidates must state where they propose to pursue their studies. They may go to the universities or colleges affording scientific or technical instruction, or they may travel abroad. But above all things it is said to be the desire of the founder of the scholarships that the *successful artisan should be encouraged to study theory*, and the *successful competitor in theory aided in getting admission into machine shops and other practical establishments.*

We can thus be sure we have a system devised and put into successful operation by one of the most able living engineers, for the purpose of accomplishing the very object which we have taken occasion to point out as so desirable to railroad companies. If, therefore, "for the purpose of bringing science and industry into closer relation with each other," they should establish similar scholarships, it seems obvious that they would accomplish the same end had in view by Sir Joseph Whit-

worth. It would of course be folly to attempt to elaborate the details of a plan to carry out this idea, but if a railroad company should establish several scholarships of from say $500 to $1,000 each, to be open to competition from their apprentices and other employees on the one hand, and the students of some technical school on the other, a practical examination could be conducted by the officers of the railroad company itself, and a theoretical examination by the professors and teachers of the school selected. These examinations could be so arranged so as to be fairly open to the student who has studied in school and the apprentice who has learned in the shop. The money of the scholarships could thus be devoted to the theoretical education of the successful apprentices, and to giving the students in theory practical experience. The scholarship money could be paid to the successful students as wages for their work. By this means educated young men could be induced to enter railroad shops, whereas otherwise they would probably not feel inclined to do so, partly because they could secure more lucrative compensation in other positions.

If this suggestion were put into practice, it would, we think, be absolutely certain at once to stimulate rivalry among the apprentices and other employees in a railroad or other shop, and it would have the practical effect of supplying the stimulus and the motive for greater exertion, which is now wanting. Some arrangement could, we think, be devised by which the services of an apprentice could be secured for a specified length of time after he was educated, or else the amount of scholarship be reimbursed to the company in case he felt it to his interest to do so.

The effect of such a stimulant to exertion cannot fail to be salutary and would, we believe, of itself much more than compensate a company or private establishment for the comparatively moderate expense involved. It would also have the very great advantage of introducing into the shops graduates of the technical schools, whose theoretical knowledge would often be found very valuable, and part of whose duties might be instructing the other employees and preparing them for the competitions for scholarship. It would also be educating these same graduates in practical matters, in which they are often so wofully ignorant. Every experienced mechanical and civil engineer knows that no school can produce thoroughly accomplished practitioners, and the insufferable conceit and pretensions of the graduates of technical schools have been and still are an obstacle in the way of the employment of educated men. Let a railroad company say to the students of any technical school that they may select, "we will pay to one or more of the students who show the greatest proficiency in knowledge of those sciences on which engineering is based a sum of —— dollars per year for —— years, and allow him all the facilities which our shops afford if he will devote himself during that time exclusively to learning practically the art of railroad engineering, subject to the directions of the persons who may be named." To its employees it would say: "To one or more of you who would show the greatest proficiency in practical and theoretical knowledge, we will pay —— dollars for —— years, to enable you to complete your education at —— school, if you will devote all your time and exertion to that end, subject to the conditions and directions which will be established."

There would, we believe, be no difficulty in devising a practicable method of conducting the examinations and carrying out such a scheme if the officers of a railroad should meet the professors of say the Stevens Institute of Technology, the Sheffield Scientific School, or the Rensselaer Polytechnic Institute, and discuss for a short time the project and the means of carrying it out. It has the merit that it could be tried on a limited scale and abandoned if it did not work well in practice.

THE ILLINOIS "REASONABLE MAXIMUM RATES."

The Illinois Railroad Law requires that the Board of Railroad and Warehouse Commissioners shall "make, for each of the railroads in the State, as soon as practicable, a schedule of reasonable maximum rates of charges for the transportation of passengers and freight and cars on each of said railroads; and said schedule shall, in all suits brought against any such railroad corporation, wherein is in any way involved the charges of any such railroad corporation for the transportation of any passenger or freight or cars, or unjust discrimination in relation thereto, be deemed and taken, in all courts of this State, as *prima facie* evidence that the rates therein fixed are reasonable maximum rates of charges for the transportation of passengers and freights and cars upon the railroads for which said schedules may have been respectively prepared. Said Commissioners shall, from time to time, and as often as circumstances may require, change and revise said schedules. When such schedules shall have been made or revised, as aforesaid, it shall be the duty of said Commissioners to cause publication thereof to be made for three successive weeks in some public newspaper published in the city of Springfield, in this State; provided that the schedules thus prepared shall not be taken as *prima facie* evidence as herein provided until schedules shall have been prepared and published as aforesaid for all the railroad companies now organized under the laws of this State, and until the 15th day of January aforesaid."

In accordance with this provision of the law, the Railroad Commissioners have made official publication of a freight schedule for the Toledo, Wabash & Western Railway, which, it is understood, will be made to apply also to the Chicago & Alton, Chicago, Burlington & Quincy, Chicago, Rock Island & Pacific, Chicago & Northwestern and Illinois Central railroads. This tariff is accompanied by a table of classifications, which is generally similar to the classifications made by the companies. No exceptions are made, and no provision for a variation of rates on freights carried at owner's risk.

The rates for one mile and less than two, are 12 cents per hundred for first-class merchandize, 10.67 for second-class, 9.23 for third-class, 8 for fourth class; 10.67 per barrel for flour and meal in car-loads; 12.73 for salt, plaster, etc., in lots of 25 barrels; 4.26 cents per hundred for all grains except wheat in car-loads; 4.68 for wheat; $8.27 per car-load for lumber; $9 for horses and mules; $8 for cattle and pigs; $7 for sheep in single-deck cars; for classes "A," "B," "C" and "D" respectively, $11.20, $9.60, $8.68 and $7.63 per car-load; and for coal 30 cents per ton in car-loads ($3 per car-load). The Toledo, Wabash & Western tariff gives a rate for every additional mile up to 247. The method of graduation may be seen by inspecting the rate for first-class goods. An addition of 0.5 cent for each additional mile is made up to 5 miles; then an addition of 0.4 cent per mile up to 20 miles; then of 0.3 cent per mile up to 30 miles; then of 0.2 cent per mile up to 140 miles; then of 0.15 cent up to 247 miles. But we will give a key to the rates, which we have made after an analysis of them, and which will enable one to find the rate for any distance for any class of freight, within a very small fraction, for the additions are not exactly regular.

CLASS OF FREIGHT.	Rate for First Mile.	Addition for Each Additional Mile up to						
		5 miles.	20 miles.	30 miles.	140 miles.	247 miles.		
First class, per 100 lbs.	12.00 cts.	0.5 cts.	0.4 cts.	0.3 cts.	0.2 cts.	0.15 cts.		
Second class, per 100 lbs.	10.67	0.4	0.3	0.23	0.165	0.13		
Third class, per 100 lbs.	9.33	0.3	0.21	0.167	0.133	0.10		
Fourth class, per 100 lbs.	8.00	0.2	0.13	0.10	0.10	0.075		
		Up to 5 miles.	Up to 20 miles.	Up to 100 miles.	Up to 135 miles.	Up to 247 miles.		
Flour and meal, per brl., in car-loads, per brl.	10.67	.....	.....	0.23 cts.	0.11 cts.	0.088		
Salt, cement, plaster and stucco, in 25 brl. lots, per brl.	12.73	.....	.....	0.36	0.13	0.105		
Grain (except wheat) and millstuffs, in car-loads, per 100 lbs.	4.26	.....	.....	0.057	0.044	0.035		
Wheat, in car-loads, per 100 lbs.	4.68	.....	.....	0.097	0.05	0.04		
Lumber, per car-load	$8.27	.....	.....	17.00	8.60	6.80		
		Up to 5 miles.	Up to 20 miles.	Up to 50 miles.	Up to 100 miles.	Up to 140 miles.		
Horses and mules, per car-load	9.00	35.0	28.0	20.0 cts.	13.0 cts.	10.00		
				Up to 30 miles.	Up to 200 miles.	Up to 247 miles.		
Cattle and hogs, per car-load	8.00	.....	24 0	12.00 cts.	10.0 cts.	9.00		
			Up to 30 miles.					
Sheep, in single-deck cars, per car-load	7.00	20.0	15.0 cts.	.....	10.0	6.00		
		Up to 25 miles.			Up to 100 miles.	Up to 247 miles.		
Class "A," per car-load	11.20	31.0 cts.	.....	26.0 cts.	17.6 cts.	11.00		
Class "B," per car-load	9.60	.....	93 0	20.0	16.5	10.50		
		Up to 30 miles.						
Class "C," per car-load	8.68	27.0	.....	.....	11.6	.....		
Class "D," per car-load	7.63	.....	16.0	.....	.....	.....		
		Up to 5 miles.	Up to 10 miles.	Up to 200 miles				
Coal, in car-loads, per ton	0.30	7.5 cts.	2.0 cts.	1.0 ct.				

If these rates were enforced for shipments between the West and the East, and no decrease per mile for distances greater than 247 miles provided, the rate on corn from Chicago to New York would be 18·63 cents for 247 miles, plus 653 (the number of miles above 247 by the shortest route) into ·035 cent (the rate per additional mile on corn for the greatest distances), which gives 22·855 cents, and would make the through corn rate 41·485 cents per hundred pounds. This is less than the usual lowest regular rate in the summer, when competition by lake and canal is most active, so that we may say that the Commissioners' tariff would impose upon the Illinois railroads a local tariff for the longer distances lower than the present through traffic on routes of the heaviest traffic for distances of nearly a thousand miles. It will be worth our while to make a New York-Chicago rate from all these classes for purposes of comparison. These will be, providing that the addition per mile for the last miles in the Illinois rates is not decreased for additions up to 900 miles, as follows:

First class per 100	$1.59	Lumber per car load	$80.61
Second class " " "	1.36	Horses and mules pr car l'd	107.10
Third class " " "	1.06	Cattle and hogs per car l'd	94.37
Fourth class " "	.80	Sheep per car load	70.52
Flour, etc., per bbl	1.04	Class A per car load	122.60
Salt, etc., per bbl	1.21	Class B " " "	113.30
Grain, exc'pt wheat, p. 100	.41⅓	Class C " " "	107.10
Wheat per 100	.46½	Class D " " "	103.75
		Coal per ton	6.10

The rates for long distances are, however, less objectionable than those for short ones, which are, on the most important freights (that is, those which form the chief part of the traffic of Illinois railroads,) very much lower than the rates the companies have received. We have shown heretofore that a comparatively small reduction of the receipts of most of the Illinois railroads would leave most of them with no surplus for dividends, and would throw many of them into bankruptcy; not that these railroads are very poor or necessarily unprofitable, but that, as with most railroads the world over, *the part of the earnings divided as profits is but a small proportion of the whole.*

A failure to appreciate this, more than anything else, makes it difficult for the ordinary mind to understand why the proprietors of railroads resist so strongly an attempt to reduce rates by what may seem a small amount.

The Railroad Commissioners are bound by the law as well as the railroad companies, of course, and they are not to blame if their tariff is unvarying and permits no discrimination for the good either of the corporation or the public. The rule holds with their tariff as with any other, under the present law, that a rate accepted at any time on any part of the road on a given class of freight is *prima facie* evidence that a higher rate for the same distance or the same rate for a less distance, on similar goods, anywhere on the lines owned by that company, is an unjust discrimination. And no discrimination is made for different lines of the same road; and the branch whose working nets a loss of $1,000 per mile (and there are not a few such branches) must be worked at the same rate as one which yields a net profit of $3,000 per mile (as several roads or parts of roads in Illinois do). So no very low rate can be given to fill cars which would otherwise return empty, and the road cannot do a business anywhere at a rate which would be unprofitable on any other part of its line or under any other circumstances, without engaging to do all of its business at all times for the same rates.

These faults of the law cannot be laid at the doors of the Commissioners, who did not make or recommend it, so far as is known. But it may reasonably be complained that when the law required only reasonable *maximum* rates, the Commissioners should have made a tariff which is in many respects unreasonably low, and which, with the inflexibility of the law, must seriously oppress corporations now flourishing, should they submit to its provisions.

Record of New Railroad Construction.

This number of the RAILROAD GAZETTE has information of the laying of track on new railroads as follows:

Smyrna & Delaware Bay.—Extended from Smyrna southwestward 9 miles to Massey's, Delaware. *Martinsburg & Potomac.*—Completed from the Potomac River opposite Powell's Bend southwest 12 miles to Martinsburg, W. Va. *Galveston, Harrisburg & San Antonio.*—Extended from Columbus westward 9 miles to Bordenville, Texas. *Wasatch & Jordan Valley.*—Extended for 2½ miles from Granite, Utah. *Toledo, Canada Southern & Detroit.*—Extended from Trenton, Mich., northeastward 14 miles to a point three miles below Detroit. *Kansas Pacific.*—Track is laid on the *Arkansas Valley Branch* from its junction with the main line at Kit Carson southwest 36 miles. *Denver & Boulder Valley.*—Extended from Erie to Hughes, Col., 6 miles. *Burlington, Cedar Rapids & Minnesota.*—Completed by laying the track from Independence, Iowa, northward 36 miles to a junction with the northern section about six miles south of West Union, Iowa.

This is a total of 124½ miles of new railroad, making a total of 2,408½ miles completed in the United States in 1873.

NEW PUBLICATIONS.

The American Railroad Manual.—A handsome volume is this, beautifully printed on paper of a delicate tint (not yellow, like

most of the abominations called "tints") and firmly and handsomely bound. The manufacture has been done with admirable taste, and does credit to Messrs. J. B. Lippincott & Co., who are among our very best book-makers. We rarely see any American book, much less a book of reference, so tastefully executed. The page is large (about 8 by 11 inches), and the somewhat imposing appearance of the book attracts attention, and deserves, we think, this mention of it as a product of manufacture.

Of its contents we shall be better able to speak six months hence, when a few thousand references to its pages shall have made us familiar with them and qualified to pass judgment on that primary qualification, accuracy. We have heretofore given an account of its plan and arrangement. While the arrangement alphabetically by States makes it easy to find any given railroad, want of tabular statements and of titles and heads in distinguishing type makes it difficult to find any special fact in the account of a road, and this defect much more than balances the advantages of the convenient arrangement of companies. The distinguishing feature of the work is its abstracts of the history of the several railroads, which can be found nowhere else, and which will often, doubtless, be valuable. For some of the more important roads a great deal of space is given to these histories. For instance, out of 7½ pages devoted to the Boston & Albany, 5½ are covered with an account of its origin and history. About 4½ out of 5½ pages is similarly occupied in the account of the "United Railroad Companies of New Jersey (which, by the way, was supplanted some time ago by the "United New Jersey Railroad & Canal Company). To the Pennsylvania Railroad and its branches 12 pages are well devoted, and on one is a very interesting table of roads controlled by and operated in the interest of this company, aside from the lines owned or leased directly. The Philadelphia & Reading gets nine pages, the Baltimore & Ohio ten, etc. The Western railroads are less fully treated, and while Illinois, the greatest railroad State, gets 40 pages, Pennsylvania has 90 pages devoted to its lines. We have not sufficiently examined the accounts of the companies to say more than they show that an enormous amount of labor must have been expended on them simply to complete so much matter in the six or seven months (or less) that Mr. Vernon has been at work, and also that in these accounts frequent statements of opinion are made, which have no place in such a book of reference, any more than in a dictionary, where, nevertheless, Dr. Johnson sometimes put them.

Technical Regulations of the Union of German Railroad Administrations.

[Translated for the Railroad Gazette.]

GENERAL REGULATIONS FOR ROLLING STOCK.

§ 157. *Wheels.*—Wheels of a good quality of wrought iron or of steel are recognized as the best, as well for locomotives as for coaches and cars.

The use of cast-iron is admissable for the naves. For wheels which are not subject to the action of a brake, the bodies may be made of wood.

Chilled cast-iron wheels may be used for freight cars which have no brakes, if they are submitted to a vigorous inspection.

* § 158. *Tires.*—Tires should have a conical form, the generatrix presenting an inclination of at least 1 in 20.

* § 159. *Width of Tires.*—The width of tires for locomotives and tenders should be 5½ inches at least and 5.9 inches at most; that of tires for cars should be from 5½ to 5.7 inches. The utilization and wearing out of tires in store which are only 5 inches wide is permitted.

* § 160. *Flanges.*—All wheels, without exception, should be provided with flanges.

* The height of the flange, measured to the point of contact of the wheel in its normal position, should not exceed 1¾ inches in the condition of greatest wear, and should be at least 1 3/10 inches.

* § 161. *Play of Flanges.*—The play between the flanges and the rails shall not to a pair of wheels a total displacement less than 2-5 inch nor more than 1 inch, even in the state of the greatest possible wear. For the middle wheels of six-wheeled locomotives, a play permitting a total displacement of 1 3-5 inches may be admitted; the interior distance between the tires shall, however, be the same.

* § 162. *Wear of Tires.*—The minimum thickness admissible for the tires of locomotives and tenders is ½ inch when they are of iron, and ¾ inch when they are of steel; and for cars ¾ inch when they are of iron, and ½ inch when they are of steel.

* The thickness should be taken at the theoretical point of contact.

§ 163. *Diameter of Wheels.*—The minimum for the diameter of car and tender wheels should be 35½ inches.

§ 164. *Diameter of Driving-Wheels.*—There is reason for adopting for the minimum diameter of locomotive driving-wheels:

a. For trains running at a speed of 15½ miles an hour...35½ inches.
b. " " " " 18½ " " " ..43½ "
c. " " " " 23 " " " ..51 "
d. " " " at a greater speed.....59 "

* § 165. The interior distance between wheels on the same axle, from tire to tire, should be, in their normal condition, 4 feet 5½ inches. A variation of ¼ inch above and below this measure is authorized.

* § 166. *Fastening Wheels on Axles.*—The wheels of an axle should be so fixed on it as to make it impossible for the relation of one to the other to be disturbed.

* Wheels loose on the axles, or axles which are not of one piece may not be used on cars intended to run on foreign lines.

* § 167. *Axles.*—The maximum gross load which axles of a good quality of iron can be made to support is fixed as follows:

8,268 lbs. for axles having 4 inches within the wheel.
12,126 " " " 4½ " " "
16,536 " " " 5 " " "

* These loads may be increased by 20 per cent. when the axles are of cast steel.

* For passenger coaches, for the sake of greater safety, axles having at least 4½ inches within the wheel should always be used.

* Axles may not have at any point a greater diameter than that of the part within the wheel. Sharp seats and shoulders next the naves should be avoided.

☞ *Observation.*—The directions of the above paragraph will be obligatory only for new material and in the renewal of defective axles.

* § 168. *Axle Journals.*—The dimensions to be given to the journals of axles are determined likewse in proportion to the gross load.

Journals shall have a diameter of 2.56 inches for a maximum load of 8,2 8 lbs. per axle.
Journals shall have a diameter of 2.95 inches for a maximum load of 12,126 lbs. per axle.
Journals shall have a diameter of 3.34 inches for a maximum load of 16,536 lbs. per axle.

* This load may be increased by 20 per cent. when these axles are of cast steel. The above dimensions relate to journals a length of 1¾ to 2¼ times their diameter.

* If the diameters of journals are found to be less, in consequence of wear, than the dimensions prescribed, they may no longer be used for the load corresponding to the dimensions given at first.

* For journals as well as for axles, sharp shoulders should be avoided; offsets should be made on a suitable curve.

Observation.—The directions of the preceding paragraph will be obligatory only for new material and renewals of defective axles.

§ 169. *Threads of Bolts.*—The "Whitworth" thread should be adopted for all the bolts of rolling stock.

RUNNING OF TRAINS.

SERVICE OF THE ROAD.

§ 170. *Part of the Road-bed to be Kept Clear.*—Outside of stations the road-bed must be clear of all materials and utensils which would present an elevation of more than 12 inches above the rails, for a width of 5 feet 7 inches from the center line of each track. All higher objects should be kept 6 feet 7 inches away, and be firmly placed.

§ 171. *Guarding the Track.*—During the day the road-guard should inspect the track at least three times; during the night, there must be, if possible, an inspection immediately before the passage of each train.

In these inspections, it is especially important that the guard make sure that the switches are in good condition.

§ 172. *Means of Control.*—Efficient steps must be taken to control the road-guards or the night watchmen in their inspections of the track and stations.

§ 173.—*Lighting.*—Grade crossings of much-frequented footwalks and neighborhood roads should be lighted at night, when trains are passing.

A lantern in the guard's hand is considered sufficient for such lighting.

§ 174. *Announcing Trains.*—The arrival of trains should be signaled to the guards at least three minutes beforehand.

§ 175. *Serving Gates.*—The gates of grade crossings should be closed at least three minutes before the arrival of trains.

Exceptions are admissible only for crossings situated near stations. Ten minutes before the passage of trains, animals may no longer go upon the track.

§ 176. *Duty of the Guard on the Passage of Trains.*—Guards should observe trains during their passage, and, if they perceive any irregularity, give the prescribed signal.

§ 177. *Arrangement of Switches.*—A fixed position must be assigned to the switches of the main track as their normal position.

§ 178. *Serving Switches.*—Sidings which full trains pass by the point of the switch should either be particularly cared for or should have their points fixed.

§ 179. *Inspection of Station Tracks and Switches.*—Before the departure and before the arrival of a train, a careful examination should be made to ascertain if the tracks which the train is to pass over are clear, and if the switches are in the positions desired.

§ 180. *Lighting Stations.*—At stations, the platforms and the roads leading to them should be lighted before and until after the departure of passenger trains.

SERVICE OF ROLLING STOCK.

§ 181. *Composition of Trains.*—Between the engine and the first coach there should be put at least one car into which passengers cannot be put.

§ 182. *Tools for Repairs.*—Every train should be provided with the things to repair, as far as possible, the damages which may occur to the train on its way, and so permit it to continue its trip.

§ 183. *Lighting Coaches.*—Coaches should be suitably lighted at night while running. This direction applies equally to coaches which have to go through tunnels whose passage would require more than three minutes.

§ 184. *Covering Cars.*—All cars loaded with inflammable materials should be suitably covered.

§ 185. *Loading Pieces of Great Length.*—Pieces of great length may be loaded upon several cars only where each of these cars is provided with a movable platform fastened firmly to the frame.

§ 186. *Arrangement of Cars.*—The couplers of the coaches of passenger trains should be screwed up so that the buffers touch each other when at rest.

Snow-plows and ice-breaker cars may not be placed in front of the locomotive of a train; when it is necessary to use them they should be attached to a special locomotive, running in front of the train at a fixed distance.

Plows not mounted upon axles and fixed solidly to the locomotive may be used.

In mixed trains, cars furnished with exceptional couplings may not be put either immediately before or immediately behind passenger coaches.

§ 187. *Length of Trains.*—The length of trains should be determined by the grades of the road, the arrangement of the stations, and the condition of the rolling stock.

In no case may a train be composed of more than 200 axles.

*§ 188. *Number of Brakes.*—In each train there should be, besides the brakes of the locomotive and tender, powerful braking apparatus, acting upon a number of sets of wheels ascertained as follows:

Inclination of Grades.	No. of sets of wheels which it should be possible to brake. Passenger Trains.	Freight Trains
1 to 500 (10.56 ft. per mile)	1-8	1-12
1 to 300 (17.6 ft. " ")	1-6	1-10
1 to 200 (26.4 ft. " ")	1-5	1-8
1 to 100 (52 8 ft. " ")	1-4	1-7
1 to 60 (86 ft. " ")	1-3	1-5
1 to 40 (132 ft. " ")	1-2	1-4

*Mixed trains, running at the speed of passenger trains, should be like them so far as the number of brakes is concerned.

§ 189. *Distribution of the Brakes.*—When a train is made up, the brakes, whose number is fixed by § 188, should be so disposed that after the last brake there will not be a greater number of axles than would correspond to one brake, according to the inclination of the grade. For long grades of an inclination of more than 1 to 200 (26.4 feet per mile), the last car should be a brake car.

§ 190. *Inspection of Trains before Starting.*—Before the departure of a train a minute inspection should be made and it should be made sure that the communication between the seats of the train guards and the steam whistle is well established, that the cars are coupled according to the rules and locked according to the regulations, that the necessary signals and lanterns are in place, and that the brakes are distributed according to rule.

§ 191. *Conditions of Starting.*—No train can leave a station before the time indicated in the official guide.

The start can take place only after the closing of all the doors, and when the signal to start has been given.

The starting of every train should be announced at the following stations by the electric telegraph.

It is recommended that arrangements be made so that trains can follow each other only at fixed intervals. When there is no regulation on this point, a train preceded by another train must not start out until five minutes, at soonest, after the other, if it runs at low speed; and ten minutes, at soonest, if it runs at a greater speed.

If two trains, one following the other, pass the post of a road-guard at an interval of less than five minutes, the guard should give the second train the signal to stop, until the interval of five minutes is re-established.

Engineers, chief train-guards (conductors), and road-guards should have well-regulated watches.

Extra trains, which do not appear on the regular time-table, should be signaled by the preceding train, if this is possible.

§ 192. *Running Speed.*—The maximum speed fixed by the rules for the different kinds of trains should not be exceeded.

Speed must be slacked:

a. When men, animals or other obstacles are seen upon the track to be passed over.

b. When a train passes a switch towards its point, and in crossing draw-bridges.

c. When the guard gives the signal for slacking speed.

When a train passes from a main track to a side track and *vice versa*, as in general at every passage from one track to another, it should run so slowly that it may be stopped if necessary within a distance of 656 feet.

§ 193. *Pushing Trains.*—The pushing of a train is prohibited unless there is at the head of the train a locomotive to guide it. This direction is not obligatory, in cases of urgency, and at stations; but the speed may not exceed 20 feet per second.

Trains having a locomotive in front may be pushed only:

a. For mounting steep grades;

b. For starting trains at stations.

Trains used in working on the road, and trains serving neighboring mines or industrial establishments, may be pushed by a locomotive.

§ 194. *Running Locomotives with the ender Ahead.*—The tender of the locomotive may not be in front on regular trains; this is permissible only in exceptional cases, at stations and for construction trains.

Tank locomotives, suitably constructed, may run forwards or backwards, on the open road and with all trains.

§ 195. *Special Trains.*—Special trains may run only at a moderate speed, if the track is but imperfectly graded, if the train has not been announced in advance to the road-guards, and at the next station according to the rules.

§ 196. *Working Trains and Locomotives without Trains.*—Working trains and isolated locomotives (except assisting locomotives) may run only on an order from the competent superior authority, and for fixed periods. Steps should be taken for announcing the running of these trains and locomotives to at least the masters of the stations at the end of the line to be passed over.

A quarter of an hour at least before the passage of regular trains the track should be clear.

Working trains and isolated locomotives should be signaled like special trains.

§ 197. *Assisting and Reserve Locomotives.*—Assisting and reserve locomotives may be stationed at intervals not exceeding 62 miles. They should be always under steam.

At the stations where these locomotives are, there should be kept also the tools necessary for clearing the track, and repairing it in case of derailment.

§ 198. *Train Crew.*—Train-men are, during the trip, unde

* Paragraphs so marked are obligatory.

the orders of a single agent. Train-men are distributed over the train in such a way that all parts of it may be watched, and so that they can communicate with the engineman.

§ 199. *Locomotives at Stations.*—Locomotives standing at the head of trains or at rest at stations should have the throttle valve closed, the reversing lever at the dead point and the tender brake on; besides, the locomotives should always be watched.

Suitable steps should be taken to hold in place cars which are not sufficiently watched and which stand still during the night, especially when there is a possibility, through violent winds or on account of the grade, that they may get upon a main track.

§ 200. *Water Level and Steam Pressure.*—The engineman should always be able by a simple glance to ascertain the height of the water level and the steam pressure in the boiler with having recourse to trials.

§ 201. *Use of Blow-off Cocks.*—At grade crossings and along parallel highways which are much frequented, the steam whistle will be used and the blow-off cocks opened only in case of absolute necessity.

§ 202. *Riding on the Locomotive.*—No person may ride on the locomotive without special permission.

§ 203. *Examination of Enginemen.*—The charge of locomotives can be intrusted only to men who have worked at least one year in a machine shop, and who have given evidence of capacity in an examination and in trial trips.

Firemen should be sufficiently familiar with the management of the locomotive to be able to stop it in case of need.

* § 204. *Trial of Locomotives.*—Locomotives can be put into service only after having been submitted to a test and shown to afford the safety required. The maximum pressure of steam authorized at the time of inspection should be inscribed legibly near the engineman's place.

Among the supplies of every principal repair shop there should be an open-leg mercury steam gauge which can be placed into communication through a tube with boilers of locomotives, in order to test the valves and the steam gauge.

§ 205. *Testing Boilers.*—Tests of boilers should be made by the hydraulic press, to a pressure equal to 1½ times the pressure permitted, if the locomotive is new.

This test will be renewed after the engine has run its first 62,000 miles, then every time that it has run 50,000 miles, and every time that the boiler undergoes important repairs, and, in all cases, after three years' service.

The result of these tests should be recorded in a special register.

A boiler which undergoes a permanent change of form during its test shall not be put into service without repairs.

At the same time with the test, a minute inspection of all parts of the engine should be made.

Important repairs, necessitating the dismounting of the working parts and followed by testing the boiler, are considered as revision.

§ 206. *Interior Inspection of the Boiler.*—An interior inspection of the boiler should be made eight years, at latest, after putting the locomotive into service. This inspection necessitates the removal of the tubes. After six more years of service, this inspection must be repeated.

§ 207. *Testing Valves and Steam Gauges.*—At every test the load of the safety valves must be verified, and it must be ascertained if the steam gauge indicates accurately.

§ 208. *Inspection of Cars.*—All cars should be submitted to an inspection periodically, after running from 18,600 to 24,800 miles. At this inspection, axles, boxes and springs should be dismounted.

German and Austrian Locomotives at the Vienna Exhibition.

The following description of these machines is from one of Professor Thurston's letters to the *Scientific American:*

They are of many types, most if not all of which are well known at home. They are now usually fitted with the American cab, a detail which the continental builders have been more prompt in adopting than have the British. The frames, instead of being made of forged bars of rectangular section, as is customary in the United States, are cut out from rolled plate, which, for heavy engines, is at least thirty millimeters (one and two-tenths inches) thick. The cylinders are usually outside, and the valves are frequently driven by eccentrics placed outside the crank pin, and without the intervention of rock shafts. The boiler is now generally made with that portion surrounding the fire-box considerably enlarged, in order to obtain a wider grate and a higher steam space over the crown sheet. Instead, however, of making the top of this portion semi-cylindrical, as is the practice in the United States, the top and sides are made flat, the outside of the boiler being thus made like a rectangular box with rounded corners. The cylindrical part of the shell surrounding the tubes is connected with the enlarged part just described, frequently by a single sheet which is cut out and flanged on the one side to take the former, and is flanged around the edges on the other side to meet the shell surrounding the fire-box. This makes a very perfect and strong connection between the two portions of the shell, and, at the same time, forms an expansion joint. It is evidently a favorite method of construction here; but whether better than our American method of accomplishing the same result it is difficult to say. These flanged sheets, such as have just been described, make rather a neat piece of flanging, and seem to be favorite *pieces de resistance* with the principal exhibitors. A number are exhibited in steel, and among these are some of the best specimens of such work to be found in the exhibition. One of the very best is shown in the Creusot exhibit, where also is the most beautifully finished locomotive engine to be found in the building. As such finish can only be given to the very best of material, this engine probably stands unequaled in material and finish by anything here. Steel is employed for nearly all parts which were formerly made in wrought iron. The favorite grade for the locomotive builder's purpose seems generally to have so small a proportion of carbon as to be properly iron. This proportion frequently falls to one-quarter of one per cent. This metal, when made from good pig iron and with proper care, is much stronger than merchant iron, except, possibly, in rare instances and with the very best and highest-priced brands; it is perfectly uniform in strength and quality, and takes a magnificent finish. This metal has a tensile strength of from sixty to seventy thousand pounds and upward, and stretches more than one-fourth before finally breaking off, and can be relied upon to do this invariably, say those who are using it. Each piece is also uniform in structure and in strength throughout.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

—At the meeting of the recently consolidated Chicago & Atlantic Railway Company at Huntington, Ind., August 9, the following directors were chosen for the ensuing year: W. A. Parke and George A. Shufelt, of Illinois; John C. Earl, J. B. Hymer, George J. Bippus, J. W. Purviance and John Studebaker, of Indiana; L. T. Hunt and Thomas Espy, of Ohio. The board subsequently elected officers as follows: George J. Bippus, Huntington, Ind., President; L. T. Hunt, Kenton, Ohio, Vice-President; L. P. Mulligan, Huntington, Ind., Secretary; I. N. Hill, Chicago, Treasurer; George Paul, Cincinnati, Ohio, Chief Engineer; Messrs. G. J. Bippus, L. T. Hunt and J. W. Purviance were appointed an Executive Committee, and J. W. Purviance, John Studebaker and Thomas Espy the Finance Committee.

—At the annual meeting of the Portland, Rutland, Oswego & Chicago Railroad Company in Portland, Me., August 26, the following board of directors was chosen: Allen Haines, N. C. Rice, W. H. Fessenden, J. W. Lane, Portland, Me.; D. W. O'Brien, Cornish, Me.; Henry V. Poor, Brookline, Mass.; Oscar F. Fowler, Bristol, N. H.; Fred. Billings, Woodstock, Vt.; John Cain, Rutland, Vt.; Gilbert Mallison, Oswego, N. Y.; W. McEckron, Jones's Falls, N. Y. Allen Haines was chosen President, John Neal, of Portland, Treasurer, and Moses Gould, of Portland, Clerk.

—Mr. Lansing Mills, formerly business agent of the Vermont Central at Boston, has been appointed Superintendent of Freight and Transportation of the Vermont Central Railroad in place of J. W. Hobart, recently appointed General Superintendent. His office is at St. Albans, Vt.

—The entire board of directors of the St. Joseph & Denver City Railroad Company recently resigned, and the following board of directors was chosen at a meeting held in New York, September 5: José F. Navarro, George J. Forest, Lawrence Wells, Thomas M. Smith, Augustus F. Miller, Henry H. Butterworth, New York; Edward W. Mealey, Hagerstown, Md. The new directors, are all, it is said, holders of the company's bonds, and the New York members, at least, are all well-known bankers or merchants of good standing.

—The stockholders of the new Cincinnati & Great Northern Railroad Company, formed by a consolidation of the Michigan and Ohio companies of the same name, met in Greenville, O., August 29, and elected the following board of directors for the ensuing year: W. A. Weston, G. W. Moore, Greenville, O.; A. S. Latiey, F. C. Le Blond, Defiance, O.; Davis Johnson, Van Wert, O.; John C. Reno, Cincinnati, O.; L. N. Keating, Hillsdale, Mich.; A. A. McCarty, J. T. Brady, George G. Roberts, Jackson Duncan, Pittsburgh, Pa.

—At the annual meeting of the Albany & Susquehanna Railroad Company in Albany, N. Y., recently, the following directors were elected for the ensuing year: Joseph H. Ramsey, Robert H. Pruyn, William L. M. Phelps, Albany, N. Y.; Minard Harder, Cobleskill, N. Y.; John Westover, Richmondville, N. Y.; John Cook, Worcester, N. Y.; Jared Goodyear, Colliersville, N. Y.; Arnold B. Watson, Unadilla, N. Y.; Ira E. Sherman, Sidney Plains, N. Y.; J. Pierpont Morgan, David Groesbeck, Samuel C. Thompson, New York City; Thomas Dickson, Scranton, Pa. Messrs. Phelps, Watson and Thompson take the places of W. A. Rice, T. Olcott and E. R. Ford. Ralph P. Lathrop, W. H. Haskell and Abraham V. De Witt were chosen inspectors of election. The board subsequently re-elected Joseph H. Ramsey, President; D. Groesbeck, Vice-President, and W. L. M. Phelps, Secretary and Treasurer.

—Mr. W. G. Swan has been appointed Superintendent of the West Wisconsin Railway in place of John H. Hull, resigned. His office is at Hudson, Wis. Mr. Swan's first connection with railroads was as office boy in the Chicago & Northwestern freight office at Chicago, from which position he rose gradually to that of Assistant General Freight Agent. For some time past he has been Assistant to Mr. S. S. Merrill, General Manager of the Milwaukee & St. Paul.

—Mr. Abram Klohs, late Master Mechanic of the Ogdensburg & Lake Champlain road, has been appointed Master Mechanic of the Rome, Watertown & Ogdensburg Railroad, in place of William Jackson, resigned.

—The new board of directors of the Cincinnati, Rockport & Southwestern Railway Company has elected the following officers: President, S. S. l'Hommedieu; Vice-President and General Superintendent, E. H. Sabine; Secretary, H. H. Latem.

—At the annual meeting of the Atlantic, Tennessee & Ohio Railroad Company at Statesville, N. C., August 28, the following board of directors was chosen: John Davidson, C. A. Carlton, M. A. White, Iredell County, N. C.; T. J. Moore, A. A. Caldwell, H. R. Helper, William Johnston, Mecklenburg County, N. C. The board re-elected Colonel William Johnston, President, and E. F. Morrison, Secretary and Treasurer.

—General J. S. Casement, the well-known contractor, has been appointed General Manager of the Canada Southern Railway, and will enter upon the duties of his position at once. Mr. F. N. Finney retires from the position of Superintendent, but will, it is said, remain on the road as Chief Engineer, his former position.

—Mr. J. P. Hulett has resigned his position as agent of the Erie Railway at Suspension Bridge, to take the general management of the Canada coal traffic over the New York Central, Erie and Great Western roads.

—At the annual meeting of the Louisville, Cincinnati & Lexington Railroad Company in Louisville, Ky., September 2, the old board of directors was re-elected, as follows: Joshua F. Speed, W. C. Hite, T. L. Barrett, T. L. Jefferson, J. P. Johnson, J. T. Tompkins, Lyttleton Cooke, E. D. Stantdford, Louisville, Ky.; E. D. Sayre, M. C. Johnson, W. R. P. Breckenridge, Henry Bell, Lexington, Ky.

—Mr. George W. Phelps, of Rochester, N. Y., has been appointed Superintendent of the Springfield, Athol & Northeastern Railroad, in place of Henry W. Phelps, who has resigned and gone into the contracting business.

—General J. W. Sprague, heretofore Assistant Treasurer and General Agent on the Pacific coast of the Northern Pacific Railroad Company, will hereafter be General Superintendent of the Pacific Division of the Northern Pacific Railroad.

—At a meeting of the stockholders of the Poughkeepsie Bridge Company in Poughkeepsie, N. Y., September 5, 11,680 shares were represented and the following directors chosen: J. Edgar Thomson, Thomas A. Scott, Andrew J. Cassatt, Strickland Kneass, Philadelphia; Alfred L. Dennis, Newark, N. J.; Andrew Carnegie, Charles G. Francklyn, David Salomon, Gardiner F. McCandless, George Innis, New York; H. G. Eastman, George P. Pelton, P. P. Dickinson, Poughkeepsie, N. Y. Messrs. Thomson, Scott, Cassatt, Kneass and Salomon are connected with the Pennsylvania Railroad Company; Mr. Dennis is a director of the United New Jersey Railroad & Canal Company; Messrs. Pelton and Dickinson are officers of the Poughkeepsie & Eastern, and Mr. Carnegie represents the Keystone Bridge Company of Pittsburgh. The directors subsequently elected the following officers: President, A. L. Dennis; Vice-President, H. G. Eastman; Treasurer, G. F. McCandless; Secretary, Charles B. Thurston; Assistant Secretary and Attorney, Robert F. Wilkinson.

—Mr. A. D. Wright, formerly connected with the Canada Southern Railway, has been appointed Engineer of the Port Dover & Lake Huron Railway.

—Mr. P. D. Cooper having resigned the office of Assistant General Superintendent of the Lake Shore & Michigan Southern Railway, the distribution of cars to divisions and to connecting roads, and the direction of the movement of trains will be attended to by Mr. C. B. Couch, Superintendent of the Erie Division. The other duties heretofore devolving upon the Assistant General Superintendent will hereafter be performed by the General Superintendent.

—Mr. Wm. Perry Taylor has been appointed Superintendent of the Buffalo Division of the Lake Shore & Michigan Southern Railway, in place of P. P. Wright, who has resigned. Mr. Taylor has been connected with the road for the last ten years past as operator, station agent, and later, train dispatcher.

—At the annual meeting of the Southern Central Railway Company, September 3, the old board of directors was re-elected as follows: A. H. Goss, Adam Miller, Auburn, N. Y.; Leander Fitts, Moravia, N. Y.; H. C. Beech, Weedsport, N. Y.; J. W. Dwight, Dryden, N. Y.; H. K. Clark, Groton, N. Y.; G. I. Post, Fairhaven, N. Y.; C. L. Rich, Richford, N. Y.; John J. Taylor, J. B. Brush, T. C. Platt, Owego, N. Y., Robert A. Packer, Towanda, Pa.; Charles F. Wells, Athens, Pa.

—At a meeting of the stockholders of the South Side Railroad Company (of Long Island) in New York, September 4, the following board of directors was elected: Robert C. Colt, Babylon, N. Y.; William Floyd Jones, South Oyster Bay, N. Y.; F. B. Baldwin, Baldwinsville, N. Y.; George F. Carman, Patchogue, N. Y.; Daniel F. Willets, William B. Litchfield, Brooklyn, N. Y.; Charles Fox, James Boorman Johnston, John D. Jones, Benjamin F. Tracy, Henry C. Hepburn, P. W. Gallaudet, S. Austin, New York. Messrs. John J. Shipherd, Jacob R. Shipherd, Elihu Hosford, W. S. Carter, T. D. Tappan, G. W. Ballon and C. H. Dewey retire from the board, and are replaced by Messrs. Carman, Baldwin, Colt, Litchfield, Tracy, Gallaudet and Austin. Of these, however, Messrs. Colt, Baldwin, Carman and Gallaudet have previously been in the board, so that the new party which came in last year has withdrawn and the old management is substantially restored. The board elected George F. Carman, President; Charles Fox, Vice-President, and Charles L. Hopkins, Secretary and Treasurer. Messrs. Carman and Fox take the places respectively of J. J. Shipherd and Elihu Hosford. Mr. Hopkins is re-elected Secretary, and succeeds C. H. Dewey as Treasurer. Mr. Fox was formerly President of the Company.

—At the annual meeting of the East Tennessee, Virginia & Georgia Railroad Company in Knoxville, Tenn., September 3, the following board of directors was elected: R. T. Wilson, Joseph Jacques, C. M. McGhee, W. R. Sevier, T. G. Barrett, S. D. Reynolds, John Talbot, Joseph H. Earnest, Robert Sneed, S. B. Boyd, R. H. Richards, Joseph R. Anderson, W. C. Kyle, R. C. Jackson, M. K. Jesup. The only change is the substitution of Mr. M. K. Jesup for Mr. James D. Cowan. Subsequently the board re-elected the old officers, as follows: President, R. T. Wilson, New York; Vice-President and Superintendent, Joseph Jaques, Knoxville, Tenn.; Vice-President, C. M. McGhee, Knoxville, Tenn.; Secretary and Treasurer, James G. Mitchell, Knoxville, Tenn.

—Mr. P. D. Cooper has been appointed General Superintendent of the Atlantic & Great Western Railroad. His appointment took effect September 3, and his headquarters will be for the present at Cleveland, O. Mr. Cooper has served on the old Michigan Southern & Northern Indiana and on the Lake Shore & Michigan Southern since 1858, fifteen years, having been successively station agent, track foreman, roadmaster, Division Train Dispatcher, Superintendent of the Kalamazoo Division, of the Northern Division and of the Toledo Division, and finally Assistant General Superintendent.

—Mr. Webster Snyder has been appointed General Superintendent of the Canada Southern Railway, in place of F. N. Finney, who becomes Chief Engineer. Mr. Snyder was the first Superintendent of the Union Pacific Railroad.

—At the annual meeting of the Newport & Dexter Railroad Company, September 3, Charles Shaw was chosen President and George Hamilton, Treasurer. The road is leased by the Maine Central Company.

—Mr. Edwin Reed, of Bath, Me., has been chosen a director on the part of that city in the Androscoggin Railroad Company.

—A general order from the Erie Railroad office appoints Mr. George U. Mayo Superintendent of the Department of Road.

PERSONAL.

—Mr. T. W. Pierce, President of the Galveston, Houston & Henderson and the Galveston, Harrisburg & San Antonio companies was married August 19 at Norwalk, Conn., to Miss Corallia Cooke, of Galveston, Tex.

—Mr. Gyles Merrill, who lately resigned his position as General Superintendent of the Vermont Central Railroad, will remain at St. Albans a short time to assist the new Superintendent, Mr. J. W. Hobart, after which he will retire to his homestead at Haverhill, N. H. It is stated that Mr. Merrill purposes to give up active business altogether.

—Mr. James B. Gregg, who has for a long time been Master Mechanic in charge of the Susquehanna shops on the Erie Railway, has resigned his position. Mr. H. L. Brown, Master Mechanic of the Eastern Division of the Erie Railway has been given leave of absence. Mr. C. Smith, Foreman of Track Repairs on the Eastern Division, has received leave of absence for an indefinite time, and Mr. C. R. Gordon, Foreman of Track Repairs on the Delaware Division, has resigned.

—Mr. P. P. Wright, who has just resigned the position of Superintendent of the Buffalo Division of the Lake Shore & Michigan Southern, has, it is said, been offered an important position on the Erie Railway.

—Mr. Ira B. Guernsey has resigned his position as Superintendent of Buildings and Repairs on the Erie Railway.

TRAFFIC AND EARNINGS.

—The shipments of anthracite coal over the various lines, given for the eight months ending August 30, were as follows: Philadelphia & Reading, 1873, 4,525,578 tons; 1872, 4,296,929 tons; increase, 228,649 tons, or 5⅓ per cent. Schuylkill Canal, 1873, 474,188 tons; 1872, 545,758 tons; decrease, 71,570 tons, or 13⅓ per cent. Lehigh Valley (nine months), 1873, 3,028,320 tons; 1872, 2,861,945 tons; increase, 166,375 tons, or 5⅓ per cent. Lehigh & Susquehanna Division, Central Railroad of New Jersey, 1873, 1,362,758 tons; 1872, 1,161,745 tons; increase, 201,013 tons, or 17¼ per cent. Lehigh Canal, 1873, 437,917 tons; 1872, 484,420 tons; decrease, 46,503 tons, or 9½ per cent. Northern Central, Shamokin Division, 1873, 413,137 tons; 1872, 364,362 tons; increase, 48,775 tons, or 13⅓ per cent. Delaware & Hudson Canal Company, 1873, 1,900,801 tons; 1872, 1,963,343 tons; decrease, 62,542 tons, or 3¼ per cent. Pennsylvania Coal Company over Erie Railway, 1873, 810,744 tons; 1872, 780,202

tons; increase, 30,542 tons, or 3½ per cent. Delaware, Lackawanna & Western Railroad, 1873, southward, 1,420,490 tons, northward, 601,630 tons, total, 2,022,120 tons; 1872, southward, 1,432,005 tons, northward, 472,815 tons, total, 1,904,820 tons; total increase, 117,300 tons, or 6½ per cent.

—The shipments of bituminous coal over the lines named were as follows for the eight months ending August 30: Cumberland coal over Baltimore & Ohio, 1873, 929,442 tons; 1872, 808,813 tons; increase, 120,629 tons, or 14¾ per cent. Cumberland coal by Chesapeake & Ohio Canal, 1873, 378,359 tons; 1872, 403,760 tons; decrease, 25,401 tons, or 6¼ per cent. Cumberland coal over Bedford Division, Pennsylvania Railroad, 1873, 52,148 tons; 1872, 22,021 tons; increase, 30,127 tons, or 136¾ per cent. Huntingdon & Broad Top, 1873, 294,289 tons; 1872, 200,283 tons; increase, 94,006 tons, or 47 per cent. Clearfield coal over Tyrone Division, Pennsylvania Railroad, 1873, 383,374 tons; 1872, 385,262 tons; decrease, 1,888 tons, or 0½ per cent.

—The earnings of the St. Louis & Southeastern Railway for the week ending August 23 were: St. Louis Division, $18,058.97; Nashville Division, $11,403.69; total, $29,462.66. The earnings of the St. Louis Division for the corresponding week last year were $17,101.00, showing an increase this year of $957.97, or 5½ per cent.

—The receipts of the Rockford, Rock Island and St. Louis Railroad Company for the month of May were: freight, $39,266.94; passengers, $15,928.29; express, mail, etc., $5,110.31; total, $60,305.54. The working expenses, including rental of track and taxes, were $59,027.64; leaving net $1,277.90, or about $4.50 per mile of road. For the 23 months ending with May the receipts were:

Freight	$1,378,666 40
Passengers	464,192 52
Express	47,293 25
Mails	42,670 50
Miscellaneous	14,073 89
Total	$1,946,876 56

The expenditures for this period were:

Transportation expenses	$1,320,754 45
Rent paid to Indianapolis & St. Louis Company	91,921 45
Rent paid to Peoria & Rock Island Company	59,416 59
State and local taxes	54,976 74
United States taxes	1,316 02
Total expenses (78½ per cent.)	$1,528,385 25
Net earnings	$418,491 31

The old construction account of $16,009,147.72 was increased by expenditures for new construction amounting to $71,611.70. The bonded debt is $9,000,000, which has had the interest reduced from 7 to 3½ per cent., and now calls for the disbursement of $305,000 per year.

—The earnings of the Denver & Rio Grande Railway, main line, for the third week in August were: 1873, $8,853; 1872, $7,726; increase, $1,127, or 14½ per cent. The earnings of the Cañon Branch (not open in 1872) for the week were $248, making the total earnings $9,101.

—The earnings of the Burlington, Cedar Rapids & Minnesota Railway, for the fourth week in August were $41,936.51.

—August 31, 209 cars of stock arrived at Harrisburg, Pa., by the Pennsylvania Railroad and were shipped eastward by the Allentown line.

—Since the opening of navigation on the Red River, 7,500 tons of freight have been transferred from the Northern Pacific Railroad to steamers and flat-boats on the river at Moorhead, Minn., and over 5,000 tons have been transferred from the river to the railroad. During the same time about 3,500 tons of freight were transferred from the St. Paul & Pacific at Breckenridge to flat-boats bound for Manitoba.

—A St. Louis dispatch of September 7 says: "The Texas cattle drive of the season is now nearly if not quite all in. The total receipts will reach about 500,000 head, of which number 260,000 were received at Ellsworth, on the Kansas Pacific; 150,000 at Wichita, on the Atchison, Topeka & Santa Fe; 75,000 at Chetopa, on the Missouri, Kansas & Texas, and Coffeyville, on the Leavenworth, Lawrence & Galveston, and the balance at other points. Sixty thousand have been driven to Colorado, Nebraska and Wyoming; 100,000 will be wintered in Kansas; about 150,000 will be taken by packers; 20,000 have been marketed at Kansas City; 50,000 will be driven to the Territories. The remainder will be wintered in the various Western States. The receipts at Kansas City are estimated at 300,000 head for the year, against 236,000 head last year."

The Kansas Pacific thus continues to take the largest share of this trade in spite of the new lines.

—The following companies have thus far reported earnings for August:

	1873.	1872.	Inc.	Dec. P. c.
Atlantic & Great Western	$477,252	$472,110	$5,152	.... 1⅛
Buri'gt'n, C'ar Rapids & M.	108,100	93,420	14,680	.... 15¾
Central Pacific	1 258,500	1,271,629	....	$13,129 1
Chicago & Northwestern	1 284,094	1,196,700	87,394	.... 7⅜
Erie	1,774 570	1,653,29	121,278	.... 7⅜
Illinois Central	748 634	783,255	....	34,621 4½
Indianapolis, B oom. & West.	156,973	117,408	39 565	.... 33¾
Marietta & Cincinnati	173 469	162,521	10,948	.... 6¾
Milwaukee & St. Paul	767 809	565,729	202,071	.... 35¾
Missouri, Kansas & Texas	320,018	171,945	148,073	.... 86⅛
St Louis Kan. City & Nor.	251,312	227,522	23,790	.... 10½
Toledo, Peoria & Warsaw	130,393	127,850	2,543	 2
Toledo, Wabash & Western	642,209	614 175	28 034	.... 4⅝
Chicago, Danville & Vincen.	65,608	57,375	8,233	.... 14⅜
Kansas Pacific	328,189	349,382	....	21,193 6⅛

—The earnings of the Great Western Railway of Canada for the week ending August 22 were: 1873, £19,877; 1872, £19,418; increase, £459, or 2½ per cent.

—The earnings of the Grand Trunk Railway of Canada, for the week ending August 23 were: 1873, £39,300; 1872, £33,900; increase, £5,400, or 16 per cent.

—The earnings of the Galveston, Harrisburg & San Antonio Railroad, for the month of July were: 1873, $23,258; 1872, $16,358; increase, $6,900, or 42½ per cent. Earnings per mile, 1873, $274; 1872, $192.

—The earnings of the Kansas Pacific Railway for the fourth week in August were: passengers, $35,275.70; freight, $61,471.87; mail, $2,055.32, total, $98,802.89. Of this amount $2,645.99 was for transportation of troops, mails and government freight.

—The earnings of the Central Pacific Railroad for the month of August were: 1873, $1,258,500; 1872, $1,271,628; 1871, $1,006,373; decrease, 1873 from 1872, $13,129, or 1 per cent.; increase, 1873 over 1871, $252,127, or 25 1-16 per cent. The earnings for the eight months ending August 31 were: 1873, $8,791,053; 1872, $8,052,755; 1871, $5,920,552; increase, 1873 over 1872, $738,298, or 9 3-16 per cent; increase, 1873 over 1871, $2,870,501, or 48½ per cent.

—The earnings of the East Tennessee, Virginia & Georgia Railroad for the year ending June 30 were: 1872-3, $1,378,358; 1871-2, $1,201,492; increase, $176,866, or 14¾ per cent.

—During the month of August, 483 trains with 8,841 cars passed westward over the bridge across the Mississippi between Rock Island, Ill., and Davenport, Ia., and 484 trains with 8,891 cars passed eastward over the bridge. During the month 184 boats went through the draw.

—The earnings of the Louisville, Cincinnati & Lexington Railroad for the year ending July 31 were: 1873, $1,210,381.95; 1872, $1,038,273.25; increase, $172,108.70, or 16 9-16 per cent.

THE SCRAP HEAP.

Prices of Rails in August.

Bigelow & Johnston report the prices of iron rails at $64 to $65, gold, for foreign, and $74 to $78, currency, for American, For steel $108 to $112, gold, for foreign, and $120 to $125, currency, for American, were the quotations. No iron rails were imported at New York in August, but the imports of steel were 16,741 tons for the month and 65,084 tons in 1873. Of iron and steel, the imports were 106,457 tons in the eight months ending with August in 1873, 128,933 in 1872, and 115,891 in 1871. Only 181 tons of old rails were imported in August, and 9,282 in the eight months of 1873, against 31,747 tons for the same time in 1872, and 26,550 in 1871.

Some important transactions in American iron rails are reported, said to involve a long term of credit.

Obeying Orders.

The Burlington, Cedar Rapids & Minnesota Railroad Company recently issued an order in which conductors and engineers were instructed to "use as little water as possible during the prevalent dry season." Commenting on this the Burlington *Hawkeye* says: "The company's employees are noted for the faithfulness with which they obey all orders."

OLD AND NEW ROADS.

Bangor & Calais Shore Line.

The preliminary surveys have been completed. The line runs from Bangor (Me.) eastward through Ellsworth, Cherryfield, Jonesboro, Machias and Cherryfield to Baring, from which place to Calais the track of the St. Croix & Penobscot road is to be used. Another line is to be surveyed, leaving this line at Ellsworth and running to Bucksport instead of Bangor.

Atchison Bridge.

The people of Atchison, Kan., voted August 29 in favor of issuing $100,000 in bonds to the Chicago & Atchison Bridge Company, which is to build the bridge over the Missouri at Atchison.

International.

The Texas Supreme Court has postponed to October the application of this company for a mandamus to compel the State Comptroller to issue the bonds due according to the company's charter. The Court stated that no further argument was needed as to the merits of the case, but only as to the power of the Court to issue the mandamus. The presiding judge intimated that the mandamus would issue as soon as the Court was satisfied as to its power to make the order.

Baltimore & Ohio.

This company has taken possession of the section of the Manassas Division of the Washington City, Virginia Midland & Great Southern road, which it recently leased. This section is from Strasburg, Va., to Harrisonburg, 50 miles, and forms an extension of the Baltimore & Ohio's Strasburg Branch. The Baltimore & Ohio trains now through to Harrisonburg.

Washington City, Virginia Midland & Great Southern.

Work on the Danville Extension is progressing well. The company has not yet decided at what point the road will cross the Dan River and enter the town of Danville.

Pennsylvania.

This company gives notice to stockholders that the fourth installment of 25 per cent. on the allotment of new stock of 1872 will be payable between November 1 and 28, 1873, and an installment of 25 per cent. on the allotment of new stock for 1873 will be due at the same time. The remaining installment of 25 per cent., it is also stated, will be received from such stockholders as may desire to pay in full their shares.

The new consolidated mortgage of $100,000,000 has been placed on record in Philadelphia. This mortgage is to secure the bonds that may from time to time be issued for the purpose of consummating the great improvements contemplated by the company. The bonds will be issued under the authority obtained from the Pennsylvania Legislature last winter.

Louisiana Bridge.

The caissons for pier number 5 of the bridge over the Mississippi at Louisiana, Mo., was sunk successfully August 28, and the masonry for that pier commenced.

New York City Central Underground.

This company has executed a mortgage to George Hunter Brown and Henry Martyn Alexander, for $20,000,000, of all its franchises, branches, connections, tunnels, viaducts, rolling stock, &c., now owned or to be acquired by the company, which has recently been recorded in the Register's office in New York. George H. Brown is President of the New York, Boston & Montreal Railway Company. It is said, however, that the mortgage given has been to remedy an imperfection in a previous security or mortgage and to protect certain bondholders and creditors of the underground road.

Cairo & St. Louis.

The grading from Murphysboro, Ill., the present terminus, to Cairo, 56 miles, is substantially completed, and all the bridges are finished except that over the Big Muddy. Iron for 40 miles of track has been received at Cairo and tracklaying from that place northward will soon be commenced.

Central Pacific.

The new track at Oakland, Cal., is now completed and is used by passenger trains. A new ferry boat for the ferry from Oakland to San Francisco is to be built. The new boat will have a capacity of 20 loaded cars, and the machinery has also been commenced in the Sacramento shop. The company contemplates building a large dry dock at Oakland where it can repair its boats instead of having the work done at outside yards.

West Wisconsin.

The suit to compel this company to relay the track taken up last year between Tomah, Wis., and Warren's Mills, has been commenced. The necessary order has been obtained from the Wisconsin Supreme Court, and the papers served on the company.

Burlington & Southwestern.

Arrangements have been made for the resumption of work on this road and its speedy completion to Stanley City, Mo., at which point it is to connect with the St. Louis, Kansas City & Northern. It is understood that Detroit parties represented by Captain E. B. Ward, who has recently been chosen President of the company, have put a large amount of money into the road and will furnish the means to complete it.

Peoria, Atlanta & Decatur.

The route of the southern end of this road has been finally located. From Decatur, Ill., north to Maroa, 13 miles, it will run parallel with the Illinois Central, thence northwest to Waynesville, and from that place nearly due west to Atlanta. This route is not very direct, but the detour has been made in order to secure a donation voted by the people of Waynesville.

Canada Southern.

The rails on the Toledo, Canada Southern & Detroit have been laid as far as Rouge River just below the Grand Trunk Junction, about three miles from Detroit and 14 miles from Trenton. Trains will shortly run into the city. The passenger depot of the Michigan Central is to be used for a time.

Freight trains will shortly begin running to Blissfield on the Chicago & Canada Southern line.

The company has begun to run freight trains over the main line from the Detroit River to Suspension Bridge. It is probable that the full opening of the road will not take place till the completion of the International Bridge.

Western Illinois Bridge.

The City Council of Quincy, Ill., has passed the ordinance granting right of way to this company, which proposes erecting a railroad and wagon bridge over the Mississippi at Quincy. The ordinance grants $24,000 a year to the company on condition that no tolls shall be charged for wagons or foot-passengers. The bridge must be completed within three years.

Boston & Albany.

This company has obtained a temporary injunction against the laying out of certain streets across its track in Greenbush.

Delaware & Hudson Canal Company.

This company is now laying track on the old grade of the Albany Northernr oad from Schagticoke, N. Y., to Eagle Bridge. The Albany Northern road was operated for some time, but was finally abandoned several years ago, and the road bed passed into the possession of the Rensselaer & Saratoga Company.

Northwestern Union.

The road from Milwaukee to Fond du Lac was opened formally September 6, by an excursion. Over 1,000 passengers were carried from Fond du Lac to Milwaukee.

Union Pacific.

The final surveys for the new depot and office buildings at Omaha, Neb., are being made. The contract for the stone and brick has been awarded.

Manhattan & Northwestern.

Grading is progressing rapidly, and the President of the company has gone east to buy the iron. The section now under construction is about 36 miles long from Manhattan, Kan., north up the valley of the Big Blue to a junction with the Central Branch, Union Pacific.

Watch Hill.

A short railroad from Stonington, Conn., to Watch Hill Point, R. I., is proposed. It would be about four miles long and more than half of the distance would be built on piling. Watch Hill Point is a noted summer resort.

New York, New Haven & Hartford.

Extensive improvements have been commenced at the depot in Springfield, Mass. New tracks are to be laid for freight trains, the present tracks being reserved for passenger trains. The ground back of the car house is to be filled in and graded for side tracks.

Portsmouth & Dover.

The work of tracklaying is nearly finished. The last section of the bridge over the Piscataqua is to be a Howe truss, 190 feet long, built by L. B. Boomer, of Chicago.

Bangor & Bucksport.

About 10 miles of this road is now ready for the ties and five miles more of grading is nearly completed. The iron has been purchased and is to be delivered by October 15. It is from the Allentown Rolling Mills at Allentown, Pa. The work of tracklaying will begin as soon as the first cargo of iron arrives. The road is about 17 miles long, from Bangor, Me., southward down the east bank of the Penobscot to Bucksport.

Penobscot Bay & River.

Liberal subscriptions are being made to the stock of this company. It is thought that work will shortly be commenced.

Illinois & St. Louis Bridge.

The board of engineers appointed to investigate the complaints made against the bridge as an obstacle to navigation met and organized in St. Louis, September 4. Testimony is to be taken from all parties interested. The board consists of General James H. Simpson, Superintendent of Western River Improvements; General G. K. Warren, General Godfrey Weitzel, Colonel William E. Merrill and Major Charles R. Suter, all of the United States Engineers.

The St. Louis steamboat men have prepared for the information of the commission a careful measurement of nearly all the steamboat craft at port. The bridge company will also submit plans and measurement relating to the bridge.

The board of engineers completed its labors September 6. The report will not be made public until after it has been submitted to the Secretary of War. The engineers made a thorough investigation of the bridge.

The erection of the steel ribs for the western arch is nearly finished, only one length remaining to be put in to complete the span.

Chesapeake & Delaware Canal.

The recent break in this canal is less serious than at first reported and boats will shortly pass through again. It is now proposed to enlarge the canal so as to allow the largest vessels to pass through.

Broad Ford & Mount Pleasant.

Answers have been filed by the directors of the Southwestern Pennsylvania Company to the complaint of the Pittsburgh, Washington & Baltimore Company in the suits resulting from the forcible attempt of the former to take possession of the Broad Ford & Mount Pleasant road. The answers contain nothing new.

Meetings.

The Rockford, Rock Island & St. Louis Company meets to chose directors at Rock Island, Ill., at noon on October 8.

The annual meeting and election of the Western Union Telegraph Company will be held at the office of the company in New York, October 8, at 12 noon. The transfer books will be closed from September 10 to October 9.

Baltimore & Potomac.

A rumor comes from Washington to the effect that this company has concluded a contract with the Philadelphia, Wilmington & Baltimore by which it acquires the exclusive right to run through trains from Washington over the latter road. If these rumors are true the Baltimore & Ohio is shut off entirely from running through trains northward from Washington over its Washington Branch. The Philadelphia, Wilmington & Baltimore Company has always heretofore adhered to the policy of granting no exclusive rights to any connecting road.

St. Joseph & Denver City.

The entire board of directors of this company recently resigned and a new board was elected, all of whom, it is said, are large owners of the company's bonds. The new board has appointed a committee to investigate the company's affairs and make a detailed report.

Plymouth, Kankakee & Pacific.

In June, 1869, Putnam County, Ill., voted to take stock to the amount of $75,000 in the Kankakee & Illinois River Railway Company and to issue county bonds to that amount, and in February, 1870, an additional sum of $25,000 was voted. In October, 1870, before any bonds had been issued, the Kankakee & Illinois River Railway Company consolidated with the

Plymouth, Kankakee & Pacific Railway Company, a corporation existing in the State of Indiana, the consolidated company becoming known by the corporate name of the Plymouth, Kankakee & Pacific Railway Company. The capital stock of the original Kankakee & Illinois River Railway Company was $100,000, with the right to increase the same to an amount equal to the cost of the road. The capital stock of the consolidated company was $2,500,000. After the consolidation took place the county officers of Putnam County issued to the consolidated company, from time to time, the bonds of the county to the full amount voted. Suit has been brought to recover the interest on these bonds, but the Illinois courts have just decided that the consolidation created a new corporation, and that the issue of the bonds to the new company was illegal and not authorized by the original vote.

East Tennessee, Virginia & Georgia.

At the annual meeting of this company held in Knoxville, Tenn., September 3, resolutions were adopted ratifying the transfer to the Southern Security Company of the contract for the purchase of the Western North Carolina Railroad made originally to T. R. Wilson, C. M. McGhee (President and Vice-President of the East Tennessee, Virginia & Georgia) and C. Y. McAden. Resolutions were also adopted authorizing the President and directors to make such sale or transfer of the Cincinnati, Cumberland Gap & Charleston road (Morristown to Wolf Creek) as will secure repayment of the money advanced to that road, with interest. The question of endorsing the bonds of the Cleveland & Ducktown Railroad Company was brought up, but no final action was taken.

New York & Oswego Midland.

This company has executed a consolidated mortgage, dated September 1, 1873, to the Mercantile Trust Company, as trustee, the amount of the mortgage being $35,000,000. The bonds issued under this mortgage are to be used to fund all the present indebtedness of the company, to complete the unfinished portion of the road, and to provide a fuller equipment. The mortgage covers all the property and franchises of the company. It is intended to make it a first mortgage by funding in it all the existing bonds.

Denver & Boulder Valley.

The extension of this road from its late terminus at Erie, Col., to Boulder City, six miles, has been completed. The road, which belongs to the Kansas Pacific Company, is now 21 miles long from the junction with the Denver Pacific at Hughes to Boulder City.

Kansas Pacific.

The track on the Arkansas Valley Branch is laid from the main line at Kit Carson, Col., southwest 36 miles. Track-laying is progressing rapidly, and it is expected that the road will be completed to Fort Lyon, 54 miles from Kit Carson, by September 20.

St. James & Chamois.

This company has been recently organized under the general law of Missouri. The road is to extend from St. James, Mo., on the Atlantic & Pacific, northward to Chamois on the Missouri Pacific. It will be about 52 miles long, and will pass through a country rich in iron ore.

St. Louis & St. Joseph.

It is said that the St. Louis, Kansas City & Northern Company, which now operates this road under a temporary lease, will shortly cease to work it and will turn it over to the owners. The road extends from North Lexington, Mo., northwest to St. Joseph, 76¼ miles.

Holden, Paola & Fall River.

The contracts are let for the construction of this road from Paola, Kan., southwest to Garnett, on the Leavenworth, Lawrence & Galveston road, a distance of 30 miles. It will form an extension of the Osage Division of the Missouri, Kansas & Texas, which is now running from Holden, Mo., west to Paola.

Atchison & Nebraska.

This company has passed the interest on its first mortgage bonds due in September. The bonded debt is $3,750,000, bearing 8 per cent. interest. No statement of the reasons of failure to pay interest has been made by the company.

Chicago & Michigan Lake Shore.

This company, which failed to pay the interest due on its bonds in July, has paid the semi-annual interest due September 1, on $500,000 of its bonds. These bonds are a first mortgage on the section of the road from New Buffalo to St. Joseph.

Kansas City, St. Joseph & Council Bluffs.

This company has, it is said, failed to pay the September interest on its 8 per cent. bonds, the amount of which is $887,000, and also the September interest on $1,400,000 of St. Joseph & Council Bluffs 10 per cent. bonds.

Burlington, Cedar Rapids & Minnesota.

Track-laying is completed on the gap in the Milwaukee Division between Independence, Ia., and last winter's terminus south of West Union, a distance of 36 miles. The whole length of the Milwaukee Division from Cedar Rapids to Postville on the Iowa & Minnesota Division of the Milwaukee & St. Paul is 110 miles.

Cedar Falls & Sigourney.

Ground was broken on this road at Cedar Falls, Ia., September 4. The road is to be of narrow gauge and to extend from Cedar falls nearly due south to Sigourney, about 90 miles. The contract for the 48 miles from Cedar Falls to Belle Plaine on the Chicago & Northwestern is let to Noyes, Hayden & Co.

New York Central & Hudson River.

This company has declared a semi-annual dividend of 4 per cent., payable October 15. The New York *Times* says:

"The accounts for the six months laid before the directors, we have reason to suppose, present a gross traffic, exclusive of the Harlem lease, of about $14,500,000, an increase of nearly two millions over the traffic of the corresponding six months of last year."

Lancaster & Delaware River.

It is said that this company has secured fresh capital, and that work will shortly be resumed and pressed forward. It is reported that the road is to be turned northward to a point nearly opposite Lambertsville, N. J., where it will meet the extension of the New Jersey Central's South Branch road, which is shortly to be built from Flemington to the Delaware.

New York Central & Hudson River.

The Albany (N. Y.) *Express* thus describes the new depot in that city:

"The new depot appears to be about completed, and only the finishing touches are wanted to make it one of the handsomest structures in the city. The building is now open, and, so far as the interior is concerned, nothing appears to be wanting. The main rooms are lofty and exceedingly attractive, done in oak and walnut sides, flooring and ceiling. The iron pillars are painted in colors, black and gold; the gas fixtures, which are neat and rich looking, are bronzed. Along the center of the whole building, in both the ladies' and gentlemen's sitting rooms, are bronzed iron chairs, which are also placed in rows along the side of the rooms. The baggage room is on Maiden lane, and connects with the gentlemen's waiting room. Wash rooms, retiring rooms, telegraph and ticket offices are conveniently located, and all the arrangements are made for the convenience and comfort of passengers. The depot, when one is in it, looks as though it was modeled after the Grand Central Depot in New York, and it will doubtless be to the capital what that magnificent building is to the metropolis. At the north end of this depot, but not connected with it other than by a covered archway, is the dining-room, which is about completed, and will be a very attractive establishment when fitted up.

"It is as large again as the old one, and has all the modern improvements and conveniences. It is said that it will be fitted up in an eminently fine manner, and the proprietors hope to make it the most popular saloon on the line of the Central Railroad. A finely paved and well-graded street has been made on the west side of the building, running to Steuben street and the Delavan House, and thence into Broadway. This will be brilliantly lighted at night, dozens of gas jets being arranged on the depot for that purpose. This will be, of course, the only carriageway to the building, and here will be the main entrance.

"Facing the river is the exit from the depot to the cars, and here it is noticed that the grade is made, and that seven sets of tracks are set and ready for use. The platform is very deep, being in some places nearly one hundred feet from the rail to the building; but it would appear that there is to be no shed or covering over the platform, which, in the event of rainy weather, will be decidedly unpleasant: for the distance from the depot to the tracks being so considerable the ladies will suffer and many a fine bonnet will be sprinkled. The new structure, which presents so fine an appearance from the river and East Albany, it is thought would be marred by placing over here a shed; but it would seem that a light and ornamental covering would in no wise spoil the architectural beauty of the building, while it would be a blessing to passengers and an additional attraction for the depot."

Marquette, Houghton & Ontonagon.

It is reported that this company is now in the hands of Delaware, Lackawanna & Western men, among them Samuel Sloan, Moses Taylor and John Stewart.

Lewiston & Auburn.

This road, which extends from Lewiston, Me., westward to the Grand Trunk near Danville Junction, is nearly completed, and will probably be opened about November 1.

Philadelphia & Reading.

Trains are now run through to Wilmington, Del., from points on this road over the Philadelphia, Wilmington & Baltimore road.

Toledo, Thorntown & St. Louis.

Engineering parties are at work locating the line in the neighborhood of Thorntown, Ind.

Portland, Rutland, Oswego & Chicago.

At the annual meeting in Portland, Me., August 27, the stockholders voted to accept the act of last winter extending the time for locating and completing their road.

Northern Pacific.

The Dakota Division is to be kept open and operated during the coming winter, and preparations are being made accordingly.

A controversy has sprung up between the company and the Puget Sound Land Company, which owns most of the town sites along the line. The Northern Pacific Company has commenced to lay out a town of its own adjoining Bismarck, which is a Land Company town, and will, it is said, transfer the terminus to the new town. The Missouri River will be crossed when the road is extended about a mile and a half above Bismarck.

Memphis & Charleston.

At the recent stockholders' meeting, held at Huntsville, Ala., August 27, the following resolution was passed:

"*Resolved*, That the stockholders in the Memphis & Charleston Railroad Company have the fullest confidence in the high ability, integrity and good faith of the officers and directors of the Southern Railway Security Company, and discountenance articles which have appeared in the newspapers indicating that the stockholders in the Memphis & Charleston Railroad Company entertain a different spirit."

This resolution was passed with special reference to the reports recently in circulation that the stockholders were about to make an effort to break the lease on account of violation of its provisions and general mismanagement on the part of the lessees.

Chicago & Saginaw.

Of this road, which is to extend from East Saginaw, Mich., west by south to Fruitport on Lake Michigan, the Grand Rapids (Mich.) *Eagle*, of recent date, says:

"Mr. E. P. Ferry, of Grand Haven, Treasurer of the company, informs us that the road from Fruitport to Sand Lake, a distance of 42 miles, will be completed ready for use January 1 next. Messrs. Thompson & Co., the contractors on the Muskegon & Big Rapids road, are building it, and will push the construction."

Pacific, of Missouri.

The St. Louis *Republican*, of September 1, says:

"The committee of engineers, employed some months ago by the citizens' committee to make plans, specifications and estimates for the proposed lowering of the Pacific Railroad track, has very nearly completed its work, and will soon be ready to make its report. In addition to the original project, the committee has made a plan and estimate of cost for a railroad connection with the levee through the blocks lying between Almond and Plumb streets.

"The engineers propose to have a tunnel from Seventh to Third streets, with an open cut from Third to Second streets, and to cross Main street about twelve feet above grade. * * The plans proposed will cost a great deal of money, probably $1,500,000, but as they are intended to meet the necessities of the case for all time to come, the cost will probably not prove an insurmountable obstacle."

St. Paul & Pacific.

The order of the Court appointing a receiver for the unfinished portions of this road provided that the receiver should secure the $5,000,000 required before work was commenced. This order has been somewhat modified. The St. Paul *Press* of September 4 says:

"On the first of September, finding that the Amsterdam parties in interest would not furnish the $5,000,000 to complete all the roads, Judge Dillon modified his order so that the restriction on the receiver is removed which prohibited him from selling any portion of his debentures unless satisfied that enough could be placed to complete and equip all of said extensions, or some one or more of the unconstructed portions, and he is authorized to proceed with the completion of 'such portion of one or more unconstructed intervals as he may deem practicable.' If the interval between Melrose and a point 12 miles south of Glyndon, part of which is already ironed, shall be completed on or before the 3d of December next, the debentures for the money so used are to be a first lien on the St. Vincent Extension line from St. Cloud to the end of the present continuation, at a point about 92 miles north of Glyndon. This decree gives the new bonds a preference over the old on a considerable stretch of road already finished and in operation. So far as all other intervals which may be completed are concerned, the first lien now given is confined to the portions completed by the receiver.

"The object of the modification is evident upon its face. The court is disposed to afford every possible facility to interested parties to complete a portion at least of the extensions, if not the whole, and thus to save a part of their lands. Judge Dillon seems to consider 'half a loaf better than no bread.' As a number of these 'uncompleted intervals' are almost ready for the iron or for the locomotive, it seems as if there ought to be no doubt about their being finished. A few days will probably tell the story."

The St. Paul *Dispatch* says:

"Intelligence received in St. Paul concerning the proposed completion of the St. Paul & Pacific Railroad this fall is to the effect that the Amsterdam parties cannot immediately raise the five million dollars necessary to complete the extension lines from St. Paul to St. Vincent and from St. Paul to Brainerd. There is already laid 139 miles of rail on the extension lines, which work has not been sufficiently completed to be accepted by the Governor. The Amsterdam parties now propose to furnish immediately the money to thoroughly complete and equip the 139 miles, thus securing the land for that amount, and also to build seventy-five or one hundred miles additional before Winter sets in. This statement informs the public what they fail to do and what they decide to do. Just now how much of new road will be constructed on each extension is not known, but it is probable that the branch to Brainerd will be completed this fall, as only 58 miles of iron still have to be laid to make that important connection. There is iron enough in the State already to lay 57 miles, and as the grading to Brainerd is substantially completed, it is probable that track-laying in that direction will soon begin. On the St. Vincent branch there are 56 miles yet to grade and 183 to iron after the 139 previously mentioned are taken into account."

The land grant expires December 3, 1873.

The Amsterdam correspondent of the *German-American Economist* of Frankfort, writing under date of August 22, says, in speaking of St. Paul & Pacific securities: "We fear that very few of the new Receiver's 10 per cent. certificates put on the market this week will be taken; it is not to be expected otherwise, as information is very scarce. The consequence will be that those not subscribed for must be sold. But will the public take up this paper?"

Philadelphia, Wilmington, & Baltimore.

The new iron bridge which is to replace the present wooden bridge over the Susquehanna at Havre de Grace will consist of 12 spans, each 255 feet in length. It is to be built by the Baltimore Bridge Company. Most of the iron work will be made at Wilmington, Del.

New Jersey Southern.

This company has purchased the old steamboat John Neilson, formerly belonging to the Camden & Amboy Company, and put her on the ferry line between Bombay Hook, Del., and Bayside, N. J. During the recent break on the Delaware Railroad, considerable quantities of fruit was sent by this line, as many as 46 car-loads of peaches having been forwarded from Bayside in one day. A new boat ferry is nearly completed.

Smyrna & Delaware Bay.

This road, the New Jersey Southern's Delaware line, is now completed from Bombay Hook, Del., west to Massey's, where connection is made with the Kent County and Queen Anne's & Kent railroads. The whole length of the road is about 16 miles.

Union Pacific.

The Land Department reports that during the month of August, 1873, the sales of land were 22,873.65 acres for $157,994.24, being an average price of $6.907 per acre. The total sales of land up to September 1, 1873, amounted to 779,518.22 acres for $3,468,489.77, an average of $4.45 per acre. The whole land grant is about 12,000,000 acres.

The Government directors have recently made a tour of inspection over the road, and will shortly submit their report to the Secretary of the Interior.

Chicago & Illinois River.

Ground was broken for this new road at Joliet, Ill., September 1. A force of 100 men is now at work south of Joliet. The whole line from Chicago to Streator, about 85 miles, is said to be under contract. The road will pass through the Braidwood coal fields.

Dakota Southern.

Arrangements are being made for the extension of this road from Yankton, Dakota, westward about 25 miles to Bon Homme.

New Mail Route.

The mail service is to be extended on the Winona & St. Peter Railroad, from New Ulm, Minn., west to Marshall, 78 miles. The compensation is not stated.

Bingham Canon & Camp Floyd.

A large amount of iron, with one engine, two passenger, one baggage and 12 flat cars have been received by this narrow-gauge Utah road, and tracklaying will begin at once.

Utah Southern.

Nearly all the heavy grading on the extension from Lehi, Utah, south to Provo is done, and tracklaying will shortly be begun.

Utah Central.

A new foundry is to be added at once to the shops in Salt Lake City. The equipment of the machine shops has been increased by a large driving-wheel lathe and several other tools built by the New York Steam Engine Company.

Mails from Washington to the West.

A Washington dispatch says; "After September 1, the through Chicago and Western mails will be sent from here (Washington) over the Baltimore & Ohio Railroad, instead of the Pennsylvania as at present. This route permits the mails to be delayed three hours longer here, while they will arrive in Chicago in time for the same distribution. This route has the additional advantage that the mails throughout the entire distance will be in a postal car under the charge of post-office agents and will only need to be transferred once—at Cincinnati. The postal car facilities of this railroad will also enable the clerks to distribute the mails for the Northwest before they reach Chicago, thus saving from twelve to twenty-four hours in the dispatching of all Northwestern matter beyond Chicago. The mails have heretofore been sent over the Pennsylvania Railroad, subject to transfer at Baltimore, Harrisburg and Pittsburgh, and have not been in charge of the agents of the post-office department, but were sent as ordinary baggage is sent. The consequence has been that all the Northwestern matter was required to be distributed after reaching Chicago, causing the delay which will now be avoided.

Chicago & Atchison Bridge Company.

The city of Atchison, Kan., voted, August 29, in favor of taking $100,000 stock in this company, which purposes building a bridge over the Missouri at Atchison. It is said that this secures the immediate building of the bridge.

Bear River Valley.

The surveys of this road are completed. It will extend from Hilliard, Utah, on the Union Pacific, southward 17.7 miles into a heavily timbered district, the principal object of the road be-

ing to bring out lumber and charcoal. The first ten miles will be straight and nearly level, but on the last seven there are several grades of 160 feet to the mile, which, however, are all in favor of the heavy traffic. It is said that the line can be very cheaply built.

Wasatch & Jordan Valley.

The track is laid for two and a half miles above Granite, Utah, and the terminus for the present winter will soon be reached.

Martinsburg & Potomac.

This road is now completed and was opened for business September 7. It is 12 miles long and forms an extension of the Cumberland Valley road from the Potomac River southwest to Martinsburg, West Va. It is leased and operated by the Cumberland Valley Company.

Cumberland Valley.

The extension of eight miles from Hagerstown, Md., southwest to and across the Potomac was opened for business September 7. This extension was completed nearly two years ago, but could not be profitably operated until the completion of the Martinsburg & Potomac road, which has just been opened.

Poughkeepsie Bridge Company.

At a meeting of the stockholders of this company, held in Poughkeepsie, N. Y., September 5, a board of directors, a majority of whom are in the interest of the Pennsylvania Railroad Company, was chosen. The directors adopted resolutions in favor of a vigorous prosecution of the work.

The boring for the foundation for the piers of the bridge over the Hudson is being pushed forward as fast as possible.

New York State Canals.

The Auditor of the Canal Department of the State of New York has completed his report for the year 1872, from which we learn that the total amount of tolls received during the year amounted to $3,072,411, derived from the following sources:

Tolls on boats and passengers		$196,094
Tolls on products of the forest		874,585
Tolls on products of animals	$1,200	
Tolls on "products of vegetable food"	1,469,314	
Tolls on other agricultural products	2,236	$1,472,890
Tolls on manufactures		71 581
Tolls on merchandise		160 703
Tolls on other articles		296,558
Total		$3,072,411

From this it appears that of the total receipts, $1,469,314 was derived alone from vegetable food, while the next largest amount was from forest products—$874,585.

The amount of tonnage arriving at tide water by way of the Erie Canal from the Western States and Canada was 2,456,000 tons; the whole amount of tonnage, the products of the State of New York, and arriving at tide water during the same period, having been 214,383.

Of wheat, the quantity which thus arrived at tide water was 11,373,666 bushels, which, including 145,431 barrels of flour, was equal to 2,420,164 barrels of flour. The total number of bushels of corn was 29,914,321. In flour and wheat, which are comprised in the returns of vegetable food, there was a decrease in the tonnage last year of 365,323 and a decrease in tolls of $28,427, but so far as the revenue from vegetable food is concerned this has been more than counterbalanced by the increase of corn and oats, which was 193,764 tons, yielding additional tolls to the amount of $305,378. In barley there was an addition of 252,880 bushels, the relative numbers being 4,749,662 and 5,002,542, yielding, including malt, an increase of $15,822 in tolls. The decrease in wheat is owing to the condition of the short crop in 1871 sent forward in 1872; during the present season the shipments of wheat have increased.

As compared with the previous year, the returns show a decrease of $28,427 in the receipts, and an increase in the tonnage of 205,482 tons. There is a notable increase of 268,533 tons in anthracite and bituminous coal.

The total amount of tonnage on all the canals for the year was 6,673,370 tons, and is larger than any previous years.

The following statement given in the report shows the number of tons of each class of property carried on the canals during the season of navigation in the year 1872, and on the Erie and New York Central railroads from the 1st of October, 1871, to the 30th of September, 1872:

DESCRIPTION OF PROPERTY.	Tons of each class carried on the canals	Tons of each class carried on the railroads	Total tons of each class carried on the canals and railroads
Products of the forest	1,950,708	597 452	2,548,250
Product of animals	5,739	1,090,478	1,096,217
Vegetable food	1,674,320	1,870,614	3,544,934
Other agricultural products	3,903	328,560	332,463
Manufactures	325,564	1,035,397	1,360,961
Merchandise	298,758	925,815	1,224 573
Other articles	2,414,288	4,059,923	6 474,211
Total tons carried	6,673,370	9,958,239	16,631,609

Railroad Taxation in New Jersey.

The State Commissioner of Railroad Taxation has reported to the State Comptroller the following valuation of property owned by Railroad Corporations in New Jersey, subject to county, township and municipal taxation:

Belvidere Delaware	$80,920
Camden & Atlantic	3,750
Camden & Burlington County	700
Central, of New Jersey	246 700
Chester	9 000
Easton & Amboy	1,350
Freehold & Jamesburg Agricultural	1,225
Hackensack & New York	5,100
Long Dock Company	4,005,661
Montclair	7,000
Erie	868,000
New Jersey Midland	84,600
Mercer & Somerset	2,000
Morris & Essex	2 089,520
Newark & New York	485,550
New Jersey Southern	11,050
Northern, of New Jersey	12,000
Paterson & Newark	4,000
Salem	1,000
Sussex	2,700
United Railroad & Canal Company of New Jersey	4,612,375
Warren	38,400
West Jersey	5,400
Aggregate	$12,577,301

In addition to the lines of the United New Jersey Company, the Pennsylvania Railroad Company leases the Belvidere Delaware, the Camden & Burlington County, the Mercer & Somerset, and the Freehold & Jamesburg, making the whole amount of its taxable property $4,696,520. The Erie, in addition to its own property, leases that of the Long Dock Company, the Northern, the Hackensack & New York, and the Paterson & Newark, making, in all, $4,890,761 of taxable property. The New Jersey Central, in addition to its own road, holds the New-ark & New York, $732,250 in all; and the Delaware, Lackawanna & Western leases the Morris & Essex, the Chester and the Warren railroads, the total of whose taxable property is reported at $2,136,920.

The report is necessarily incomplete, many local assessors having failed to report to the State Commissioner.

Several companies will, it is said, contest the validity of the law, and it is not probable that the local taxes will be paid without some litigation.

Cairo, Arkansas & Texas.

Tracklaying on this road is progressing rapidly, and it is thought that the road will be completed to Poplar Bluff, Mo., the junction with the Arkansas Branch of the St. Louis and Iron Mountain, by September 15. As soon as this is done, the whole force will be put at work at Greenfield's Landing (on the Mississippi, opposite Cairo, Ill.), building the landing and the incline leading to the river.

New York & Oswego Midland.

This company's agents are now at work in the towns along the line of its Buffalo Extension, making efforts to procure town bonds in aid of the building of the road. Commissioners have already been appointed in the towns of Amherst and Newstead, and other towns are preparing to follow suit.

Southern Minnesota.

The St. Paul *Press* of September 5 says: "Last winter the State Railroad Commissioner sent down to the auditors of the different counties through which this road runs lists of certain lands to be placed upon the assessment rolls of the several counties and taxed in common with other lands. As these lands, however, have never passed out of the railroad company's hands, but were simply set apart for a special mortgage trust, the trustees for the bondholders have appeared during this week before the boards of county commissioners of the various counties and protested against their taxation, holding that, like any other railroad land, they are exempt."

Toledo, Wabash & Western.

This company has received its first shipment of steel rails from France. The work of relaying the main line with steel is rapidly progressing.

Northern Pacific—Pacific Division.

The track on the extension from Tenino, W. T., to Tacoma is laid to the Nisqually River, and the bridge over that river is being put up. From the Nisqually bridge to Tacoma, the distance is 23 miles, most of which is graded, the working parties being within two miles of Tacoma. The work of clearing the site of the terminus at the latter place is going rapidly forward. The completed line south of Tenino is being improved by widening cuts and cutting away banks at several places where there has been trouble from land slides.

Galveston, Harrisburg & San Antonio.

Track on the extension from Columbus, Tex., westward is laid to Bordenville, nine miles from Columbus. There is iron enough on hand to lay about half the extension of 40 miles.

Chicago & Tomah.

Subscriptions to the amount of $95,000 have been made in Grant County, Wis., in aid of this narrow-gauge project.

Niagara Suspension Bridge.

An exchange says: "This great structure, which connects the New York Central and Great Western railways over Niagara River, has been for months past undergoing improvement. It has been thoroughly inspected, with a purpose to discover the condition of its anchorage and concealed parts. Everything was found to be as perfect as when laid, twenty years ago. The entire woodwork has been replaced with new, and there is nothing about the bridge which is not just as perfect as on the day it was first completed. A strong new chord has been put under the carriageway of the bridge, and the one above has been rebuilt. Engineers declare that the bridge could not fall if the cables were wholly removed. The popular idea has been that the whole weight of the structure depended on the cables. Those cables that have so long supported a bridge full of loaded cars without flinching will no doubt long continue to do all that is required of them."

New Jersey Midland.

The permanent lease of this road to the New York & Oswego Midland Company has at last been completed, and the papers were signed a few days since. The following summary of the lease, the terms of which are very favorable to the New Jersey Company, is given by the Paterson (N. J.) *Press*:

"The New Jersey Midland Railway, with all its property and franchises, is leased in perpetuity to the New York & Oswego Midland Railroad Company, which assumes all the obligations and liabilities of the leased road. It agrees to pay the floating debt of the New Jersey Midland (about $265,000), paying $1,500 a day for the first ten days, and $2,000 daily thereafter until the whole is paid. On December 25, next, it will pay $15,000, to make good 7 per cent. dividends to those stockholders who are secured by special contracts; June 25, 1874, it will pay $22,500 for the same purpose, and June 25, 1875, the same sum for the same object. December 25, 1875, and yearly thereafter forever the New Jersey Midland is to receive $52,000, being 7 per cent. on the capital stock. The New York & Oswego also assume all the debts of the New Jersey Midland, as before said, embracing $3,500,000 of first-mortgage bonds, about $1,500,000 of second-mortgage bonds, beside the consolidated gold bonds—in all, including the capital stock, about six millions of dollars, necessitating an annual outlay of about $500,000 yearly to make good simply the 7 per cent. interest on the first cost of the road, to say nothing of the expenses of annual construction, operating, etc. The trifle of $3,000 is also to be thrown in annually to provide for the expenses of the staff of officers of the New Jersey Midland Company.

"Furthermore, the lessees agree to buy or build extensions or branches of the New Jersey Midland in connection with the latter, issuing the stock of this road, and paying 7 per cent. thereon, on the certificate of the New Jersey Midland engineers.

"In short the lease is one in every respect exceedingly favorable to the New Jersey Company, and secures the interests of the stockholders and bondholders probably better than they could have been secured by the operation of the road as an independent enterprise, especially as it has no western outlet except *via* the New York & Oswego Midland road. Furthermore, there are the usual provisions for re-entry by the New Jersey Midland, in case the foregoing and other stipulations are not fulfilled. In case of failure for three days to make the payments for the floating debt, the New Jersey Company may re-enter, but the New York & Oswego Company may still redeem their obligations within six months. If the interest coupons are not paid within five days after due, precautions are stipulated for making good the delinquency, with interest."

The *Press* adds:

"Among the obligations of the New Jersey Midland Railway Company thus assumed by the lessees is one that freights between Paterson and New York should be at least as low as the old rates on the Erie Railway; that commutation between Paterson and New York should not exceed $50 yearly, and that excursion tickets should be sold at fifty cents."

It further states that the New York & Oswego Midland Company continued to postpone the final execution of the lease until the New Jersey Company had actually commenced proceedings in Chancery to set aside the original agreement.

The length of the road is 71½ miles, so that in addition to the bonus of $265,000 the annual rent will be at the rate of about $7,000 per mile, to earn which the road should do a business of at least $21,000 per mile.

Mutual Transportation Company.

A company by this name has been organized in Chicago with a capital of $50,000, the corporators being William C. Flagg, of Madison County, Ill.; L. D. Whitney, of Bureau, Ill.; R. K. Jones, of Quincy, Ill.; Frank Gilbert and J. L. Baker, of Chicago. The object of the company is to own and lease cars and carry on a general transportation business on the railroads of Illinois and elsewhere. The railroads now transport cars belonging to transportation companies, but insist upon fixing the price to shippers. The new company will, it is said, insist on fixing its own rates, and will offer its cars to the railroads for transportation, tendering a "reasonable compensation."

Williamston & Tarboro.

This road was sold at Tarboro, N. C., August 26, by the assignee in bankruptcy, J. E. Moore. The shares of the North Carolina stockholders, about $20,000, were sold to H. D. Robeson for $1, and those of the Norfolk stockholders, about $6,000, were sold to Mr. B. Harrison for $11. The road itself was sold to L. P. Bain & Co., the holders of the bonds, for $40 in cash and $112,000 in first-mortgage bonds. The road extends from Tarboro, N. C., the terminus of a branch of the Wilmington & Weldon, eastward to Williamston on the Roanoke, 32½ miles. It is all, or nearly all, graded and about eight miles of iron is laid.

Western North Carolina.

In the Rowan County (N. C,) Court recently, Mr. R. Y. McAden obtained judgment against the Company for $260,000.

Jackson & Hudson.

A special meeting of the stockholders of this company is called to be held in Hudson, Mich., September 24. The object of the meeting is to amend the articles of association so as to extend the route and change the termini of the road, or to dissolve the organization.

Selma & Gulf.

This road, whose bonds were guaranteed to the amount of $16,000 per mile by the State of Alabama, is advertised to be sold by the Governor of that State. The route of the road runs nearly due south from Selma, Ala., to a junction with the Mobile & Montgomery at Pollard, a distance of 100 miles. It is completed and in operation from Selma to Pineapple, 40 miles.

Indianapolis, Cincinnati & Lafayette.

A proposition to have the shops removed from Indianapolis to Ingalston has been declined by the company.

Boston, Clinton & Fitchburg.

This company has decided to build a branch from Pratt's Junction (the junction of its own line with the Fitchburg & Worcester) westward to East Princeton, and thence northwest around the base of Wachusett Mountain and through Westminster to Gardner, where junction will be made with the Vermont & Massachusetts road. The length of this branch will be about 15 miles, and it will give the company a better connection with the Vermont & Massachusetts than the present one through Fitchburg, the distance from Pratt's Junction to Gardner by the present line being 24 miles. The company has also purchased Wachusett Mountain and will, it is said, build a large hotel there and a carriage road to the summit of the mountain, and anticipates considerable profit from summer travel to that point.

Central Pacific.

This company has recently adopted a new tariff on through freights eastward from San Francisco. To Ogden and Corinne the rates per 100 pounds are: first class, $2.75; second class, $2.30; third class, $1.85; fourth class, $1.40. Tea and wine are charged first-class rates, dried fruits second class, while rice, coffee, sugar, flour and grain, with canned goods and salt fish are included in the fourth class. There are also special rates for car-loads varying from $140 to $370 per 20,000 pounds, to Ogden, and from $155 to $410 for Salt Lake.

To Chicago and St. Louis the rates are the same, being $6 per 100 pounds for first class, $5 for second class, $4 for third and $3 for fourth class. There are also four special classes, the rates for which are: class A, $2.50 per hundred pounds; class B, $2.25; class C, $2.00; class D, $1.75.

Erie.

Mr. George Reddington, late Superintendent of the Delaware Division, has been arrested on a charge of defrauding the company of some $3,500. The alleged frauds are said to have been committed in connection with a contract for furnishing ties to the company. It is also charged that other officers of the company are implicated.

The line thus far surveyed for the proposed short cut from Port Jervis eastward runs from Port Jervis southward to Beemerville in Sussex County, N. J., then turns northwest to near Unionville, running thence nearly due west to Greenwood Lake, which is crossed near the northern end. From the lake the line runs southwest to the present line in the neighborhood of Ramsey's. From Port Jervis to Ramsey's the distance by this line is about 40 miles, against 60 by the existing line, and it is said that the highest grade required will be 30 feet to the mile, except in one place, near Beemerville, where a short grade of 50 feet will be required. There will, however, be some heavy work on the line. On the present line, going westward, the highest grades are 62½ and 60 feet to the mile, near Middletown, and 56 feet at Otisville, while going eastward there is a continuous up grade 12 miles long, from Port Jervis to Otisville, varying from 32 to 46 feet to the mile, and some two miles near Oxford, where the grade is over 61 feet to the mile.

South Mountain & Boston.

Ground was broken for this new road at Blairstown, N. J., September 3. The road is intended to be an extension through New Jersey of the South Mountain road of Pennsylvania from the Delaware River northeast through Warren and Sussex counties to the New York line.

Easton & Amboy.

The grading of the road under the tracks of the New York Division of the Pennsylvania road at Metuchen, N. J., was commenced recently. It is a work of some difficulty, as it must be done without interfering with the almost continual passage of trains on the Pennsylvania track.

Pennsylvania—New York Division.

The third and fourth tracks are completed from the Scott avenue station in Rahway, N. J., north to Linden, about three miles. The grading for the third track is completed nearly to Elizabeth station and that for the fourth track is progressing. Grading is going on for the third track between North Elizabeth and Waverley.

Both the Pennsylvania and the New Jersey Central will shortly lay their third and fourth tracks past the crossing of the two roads at Elizabeth. This grade crossing is a constant source of trouble and delay to the very large traffic on both roads, but no practicable plan for avoiding it has yet been devised. The question is further complicated by the fact that at that point the tracks are crossed by three streets on which there is a very large travel. The main depot in Elizabeth of both roads is located at the crossing. The city authorities of Elizabeth are now endeavoring to effect some arrangement by which the streets can be carried under or over the railroads, but either plan would involve a large expenditure of money and would not help the railroads in solving their special problem.